Development of Bioassessment Procedures for Non-Forested Depressional Wetlands in Michigan

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ABSTRACT

Studies during 2002 through 2004 have focused on the vegetation of both forested and non-forested depressional wetlands. This report focuses on the sampling of non-forested depressional wetlands, primarily within the Jackson Interlobate, with some sampling also being conducted within a few miles of the Lake Michigan shoreline on the sand lakeplain of the Manistee Subsection. In the Jackson Interlobate, 742 plots were sampled at 18 sites, while 65 plots were sampled at 4 sites in the Manistee Subsection. Land use based on aerial photo interpretation (MIRIS) of 1978 photography was conducted within a one kilometer diameter of all sites.

Twinspan Ordination was conducted to identify clusters of ecologically similar transects and sample sites. The ordination identified clusters based largely on regional differences in the vegetation, but transects within extremely disturbed agricultural and urban sites also clustered.

Correlations between land use classes (agriculture, urban-residential, and forest-water cover types) and plot vegetation were investigated at both the site and transect scales. Correlations between land use and potential vegetation indicator groups were low for all variables investigated. The study indicates that the scale of response to agricultural and urban disturbances can be quite local, with two or more transects at the same site showing different response levels to the same disturbance event.

Soils variables were responsible for regional differences between the Jackson Interlobate sites and the Manistee Subsection sites near Lake Michigan. Deep organic soils characterize almost all sites in the interlobate, while soils near Lake Michigan were sands, with only one of these sites having organic soils.

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INTRODUCTION

For more than two decades, aquatic biologists have been seeking to develop biotic indicators of ecosystem health that display both a sensitive and consistent response to specific anthropogenic stresses. Most studies have focused on fish and invertebrates to develop widely applicable measures of stream health (Karr, 1981; Karr and Chu, 1997). The search for faunal indicators has expanded into Great Lakes coastal wetlands; fish and invertebrates remained major focal groups (Burton et al., 1999; Kashian and Burton, 2000). There has been an increasing interest in recent years to use plants as indicators of aquatic ecosystem health in both inland and Great Lakes coastal wetlands (Stewart, 1995; Gernes and Helgen, 1999; Stewart et al., 1999; Simon et al., 2001; Kost, 2001).

To date, most of the published literature on plant IBIs for Great Lakes coastal wetlands has focused on highly degraded wetlands along southern Lake Michigan (Stewart et al., 1999; Simon et al., 2001). There are, however, recent studies on wetlands in other portions of the Great Lakes where levels of wetland degradation are not consistently as extreme as in wetlands along southern Lake Michigan, including wetlands along Lake Huron's shoreline (Tepley et al., 2003).

In this study, we evaluate plants, especially aquatic macrophytes, as potential indicators of inland depressional wetland health for Lower Michigan. Furthermore, we attempt to identify multiple plant metrics for an entire site. Sampling is conducted along short transects, with plant coverage values, water depth, and substrate characteristics described at each sampling point along the transect.

METHODS

Field Methods

Transects were established along ecological gradients within non-forested wetlands in Lower Michigan. The length of the transects was based on the size of the wetlands, with sampling points 5 meters apart and transects typically consisting of 15 to 20 sampling points. Vegetation cover for each plant species was estimated in 1 m^2 sampling plots along the transect. Plant coverage values were estimated in percent.

Data Analysis

TWINSPAN or Two-Way Indicator Species Analysis was used to identify distinctive patterns of plant species co-occurrence. TWINSPAN is a polythetic divisive method of classification of samples based on the differential occurrence or abundance of indicator species (Hill, 1979). The program first ordinates the samples and then uses this ordination to obtain a classification of the species according to their ecological preferences. The two classifications are presented together in an ordered two-way table that expresses species' relationships across a gradient defined by the ordering of the samples. The approach groups similar sites and similar species.

Correlations between land use and plant coverage were computed. A regression line was drawn and R-squares computed. These correlations explored relationships among sites based on the summary of all transects at a site as well as vegetation summaries for individual transects.

Land-Cover Analysis

For land-cover analysis of non-forested wetlands, MIRIS GIS coverage based on 1978 aerial photography was used, classifying the land use as agricultural, urban-residential, and natural-water. Land-use was coded within 1.0 km of the sampling sites.

STUDY AREA

Sampling plots for the sites within the Jackson Interlobate are shown in Figure 1 through Figure 4. The Jackson Interlobate (Albert, 1995) is an area of carbonate-rich sandy moraine ridges and poorly drained outwash sands, with numerous large and small wetlands and lakes occupying ice-block depressions within the outwash (Figure 1). Our sample sites are concentrated in two areas, a southwestern area in western Washtenaw County and a northeastern area in Oakland County (Figure 2). The original upland forests were largely oak dominated, with either white oak-black oak forests or more open black oak barrens on droughty sites (Figure 3). Wetlands were a mix of wet prairie, marsh, and tamarack-dominated swamp forest. Current land use in the southwest (Washtenaw County) is more of a mix of agriculture and forest than in the northeast (Oakland County), where urban and suburban land use is more common (Figure 4).

Aerial photos of the Jackson Interlobate sites (Appendices 1.1-1.17) include the typical land use of the region, with a mix of forested recreational lands, agricultural lands, often abandoned and slowly returning to forest conditions, and varying densities of residential development. Attempts were made to drain many of the wetlands for agriculture, while most residential development was concentrated on uplands or lake margins. Land use will be discussed in more detail within the context of the individual sites during the discussion of wetland vegetation analysis.

Four non-forested wetlands were sampled in Mason County three to four miles inland from Lake Michigan, just north of Hamlin Lake and east of Ludington Dunes State Park. All sites were within a couple of miles of each other on pitted outwash and lacustrine sands within the Manistee Subsection (Albert, 1995), where the original vegetation consisted of open white pine and white oak forests and savannas. Fire, both resulting from natural causes and human management was responsible for the dominance of oaks and pines. These upland forests have been replaced by white oak and black oak following severe post-logging fires. Wetlands in the subsection include both non-forested wetlands and forested wetlands of jack pine. Topographic maps rather than aerial photos are provided in the report for the four Lake Michigan sites. All of these sites are located in forested landscapes of the Manistee National Forest, where there has been no recent agricultural development, although nearby there is both agricultural and residential development. The variability of these wetlands is more a product of natural hydrologic conditions than intensive human land management, although logging and post-logging fires have undoubtedly influenced vegetation and wetland sediments as well.

The Lake Michigan sampling sites are shown on topographic maps (Appendix 1.18-22). Three of the plots, Stone Road, Nurnberg Road, and Forest Hill Road are located in small depressions on relatively flat sand lakeplain or outwash. Nurnberg Bog and Nordhouse Marsh are located in depressions between sand dunes, where the topographic relief is much steeper.

RESULTS AND DISCUSSION

Vegetation Analysis

Vegetation data from plots is summarized in Appendices 2.1-2.23. Jackson Interlobate sites are in Appendices 2.1-2.18 and Manistee Subdistrict sites in Appendices 2.19-2.23. Vegetation is summarized into both taxonomic groups and physiognomic groups considered relevant for identifying quality differences between wetlands (Gernes and Helgen, 1999;

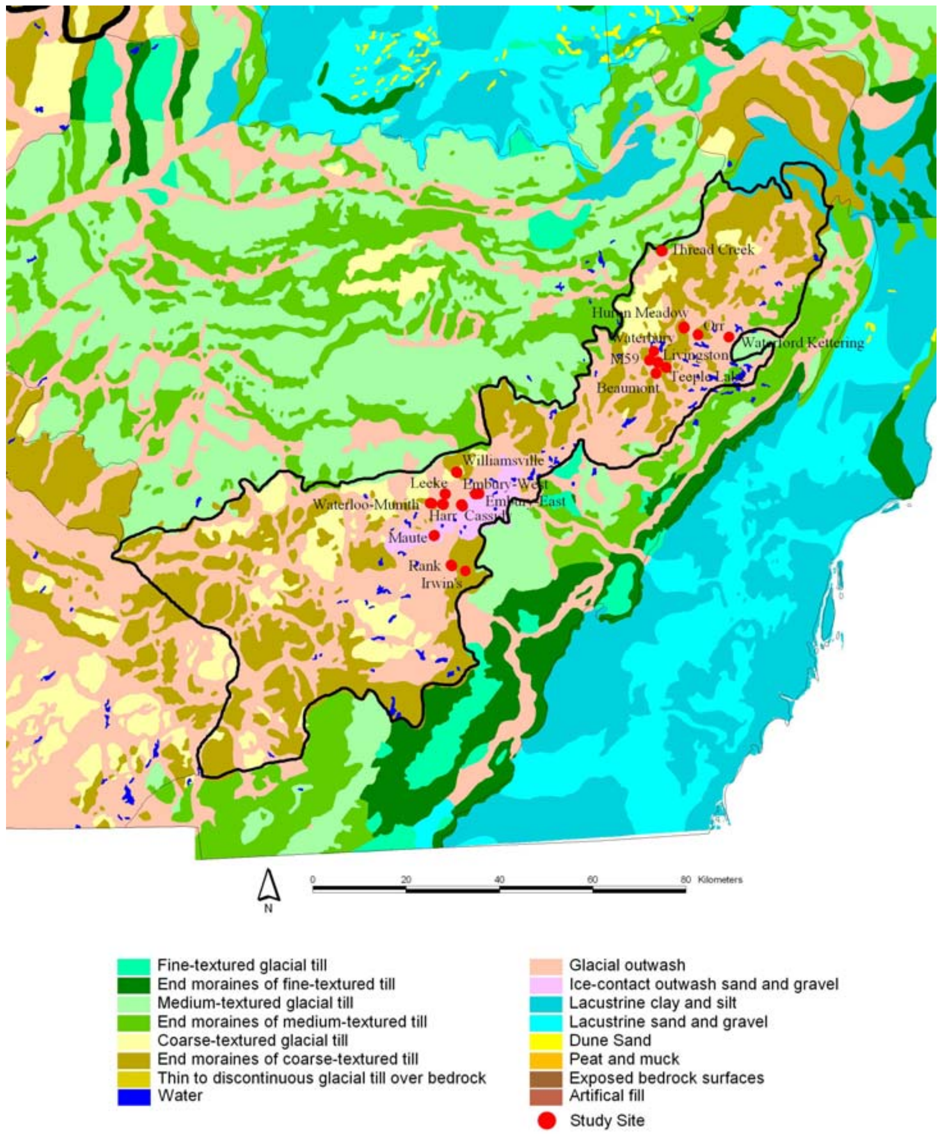

Figure 1. Glacial geology of the Jackson Interlobate.

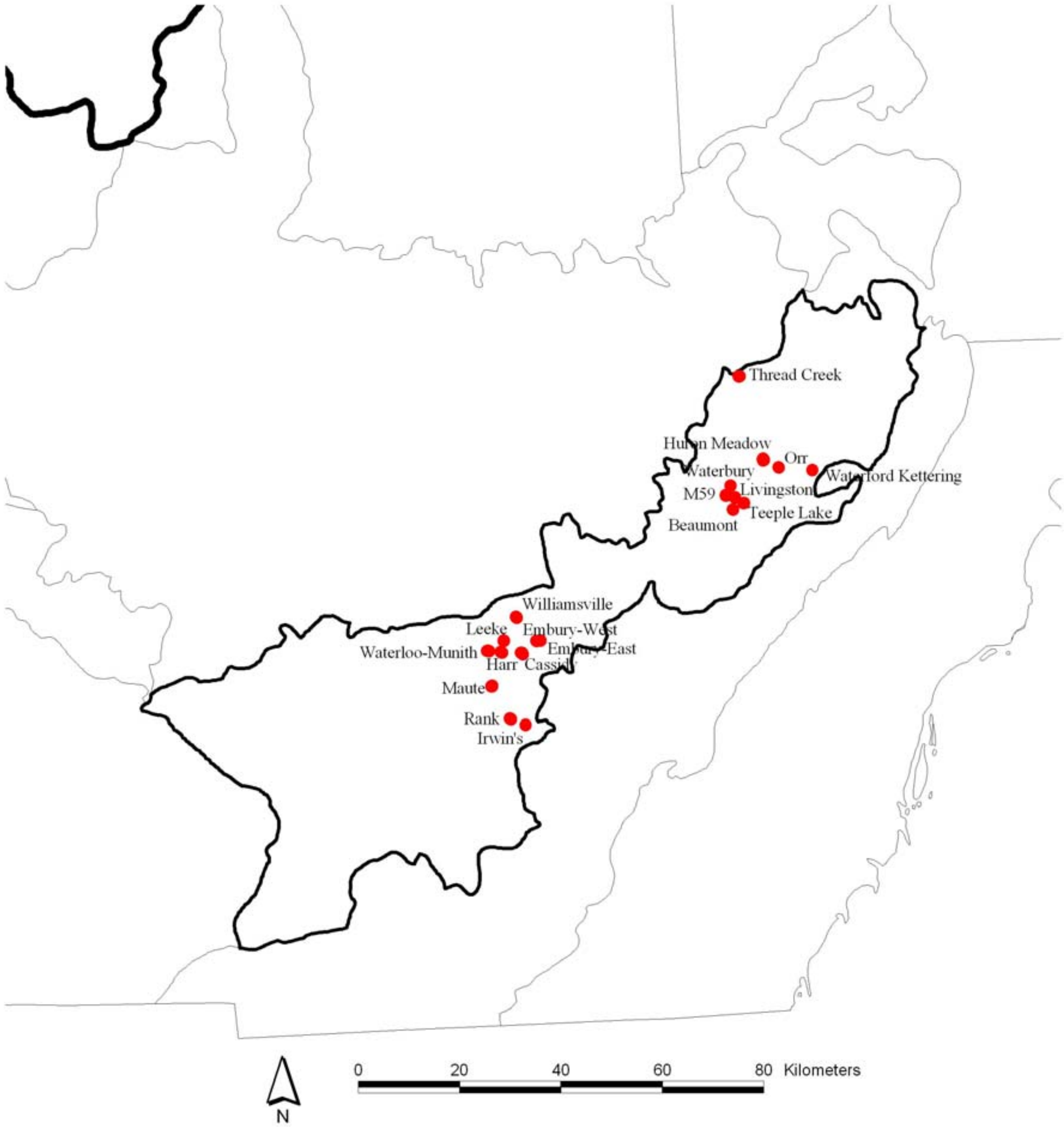

Figure 2. Sample sites within the Jackson Interlobate Subsection.

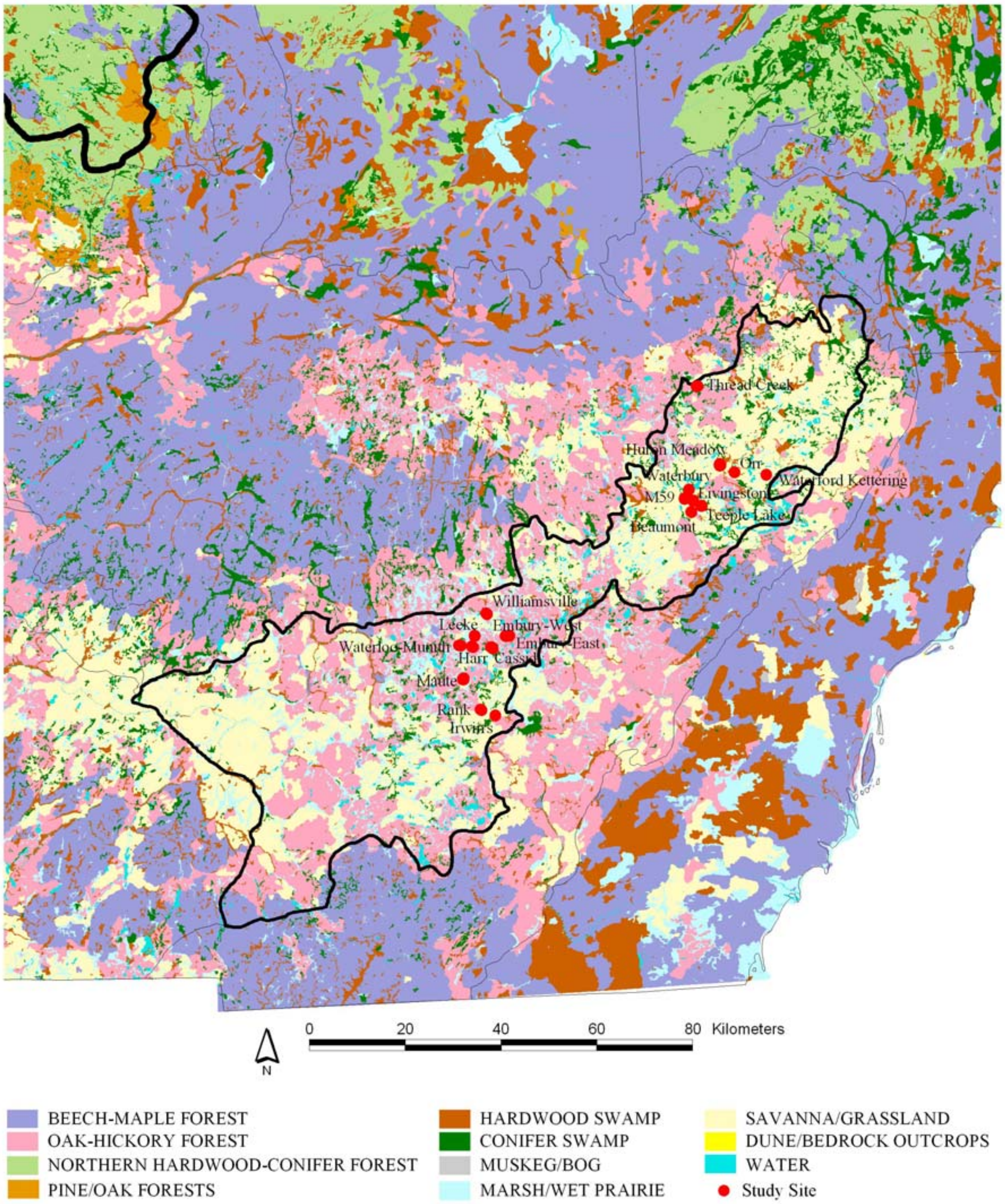

Figure 3. Original vegetation of the Jackson Interlobate.

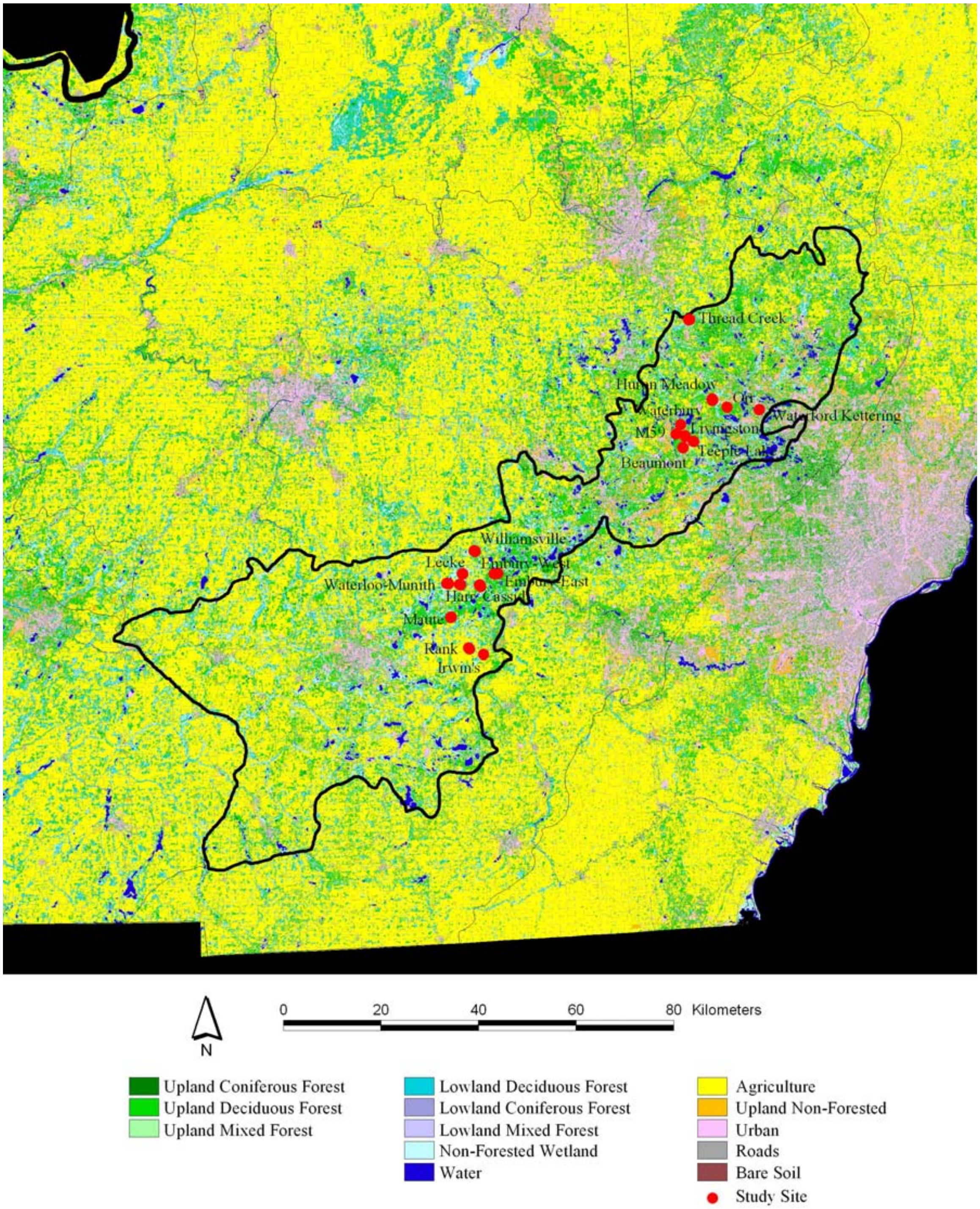

Figure 4. Land use of the Jackson Interlobate in 2000.

Kost, 2001; Simon et al., 2001; Stewart et al. 1999). These groups include graminoids, forbs, ferns, shrubs, and trees. Further groups identified for analysis include the total number of native species at a site, and both the number of exotic species and their mean coverage along each transect or within each site. The Floristic Quality Index is also computed from all of the species found at each site. All of these variables are viewed as potential indicators of wetland quality, based on results from other wetland studies in the Midwest.

TWINSPAN Analysis

TWINSPAN analysis (Appendix 4) was conducted on the summarized plot data (Appendices 2.1-2.25) to identify groups of plots that were responding to either regional physical differences or land use differences affecting wetland vegetation. The first group identified consisted of three plots from the plot with the highest levels of agricultural land use, the Maute Road site. The second group consisted of a single plot, the Nurnberg Bog site. This site was unique from other sites in two dimensions; it was the only Lake Michigan site with deep organic soils and the vegetation consisted of bog species not encountered in any of the other sites. The third separation isolated five plots, which includes the three remaining sites along Lake Michigan where sandy soils predominate and is unlike the organic sediments that characterize almost all of the Jackson Interlobate sites. However, the two remaining sites share few other characteristics with these sandy western sites.

TWINSPAN's separates most of the sites into a southwestern Washtenaw County group and a northeastern Oakland County group, with several cross-over plots in both groups. The ecological significance of this break is not apparent. The Oakland group contains the plots with the highest levels of residential development, with the exception of Waterford Kettering. While the TWINSPAN analysis does identify meaningful groups of related plots, it does not identify any groups of plants that are consistently associated with degraded sites.

Soils data was not extensively used in analyses, as almost all of the Jackson Interlobate sites were characterized by organic soils and circumneutral pH, while the Manistee Subsection were consistently sandy, with organic soils characterizing only one of five wetlands (Appendices 3.1-3.23).

Indicators of Wetland Quality—Site-Wide Analysis.

The next phase of the analysis was to search for site-wide indicator species or groups that correlated with land-use differences. For this analysis, data from all plots was summarized for each sampling site. The number of exotic species was expected to increase as the amount of natural forested lands decreased at a site (Figure 5). Instead, correlations were low between amount of natural lands and number of exotic species at a site ($R^2 = 0.0622$). The correlation between the total coverage of exotic species at a site and the amount of agricultural or residential development was also low (Figures 6 and 7), with low R^2 values. The number of native species is expected to increase with larger amounts of natural lands, and this relationship was also weak (Figure 8; $R^2 = 0.2349$). Finally, several other groups of species are expected to respond negatively to disturbance, including number of native graminoid species, native forbs, native ferns, and native shrubs (Gernes and Helgren 1999, Stewart et al. 1999). No strong relationships were found between any of these indicators (Figures 9 and 10). Finally, we explored the effect distance of disturbance had upon the coverage values of exotic plant species at a site (Figure 11). The distances from the closest disturbance, including agricultural fields, ditches, roads, and ponds, ranged from 5 meters

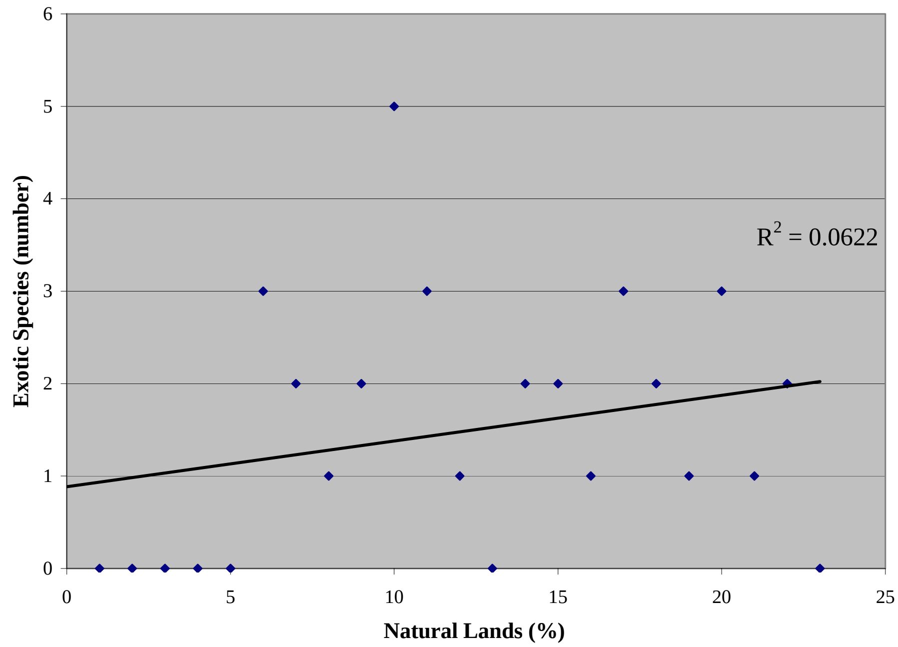

Figure 5. Relationship of exotic species numbers to the amount of natural lands.

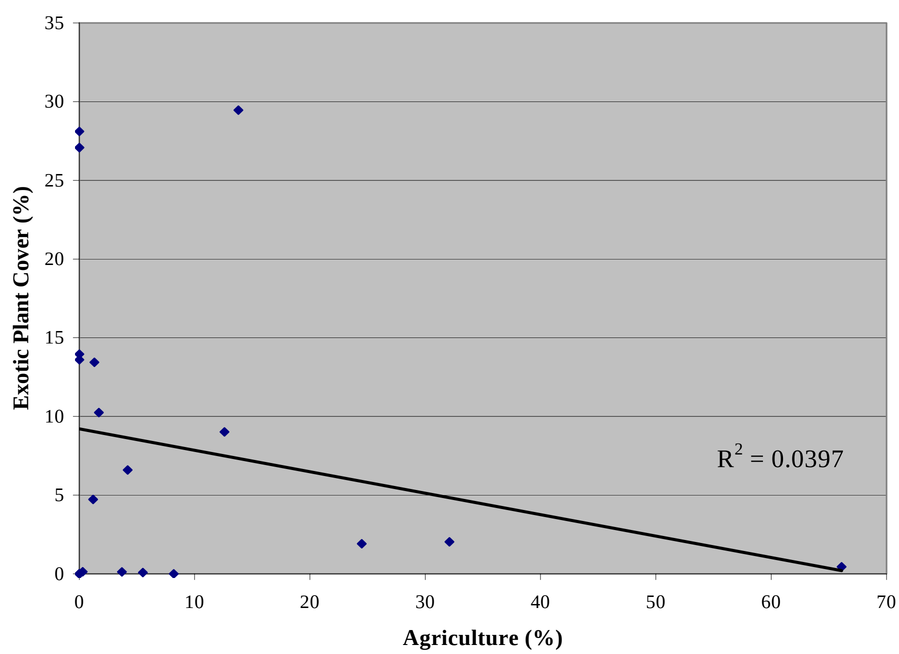

Figure 6. Relationship of exotic plant cover to the amount of agriculture.

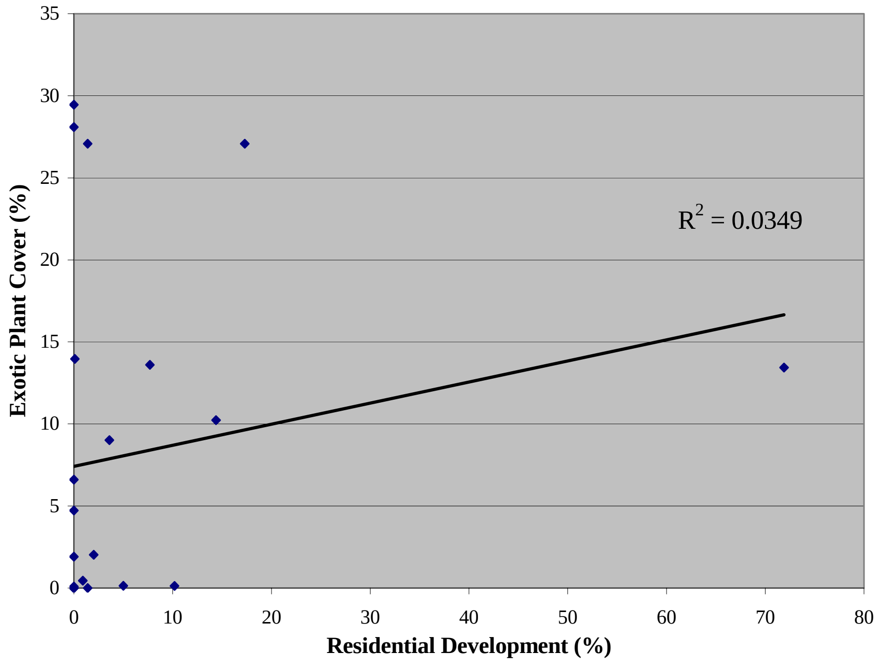

Figure 7. Relationship of exotic plant cover to the amount of residential development.

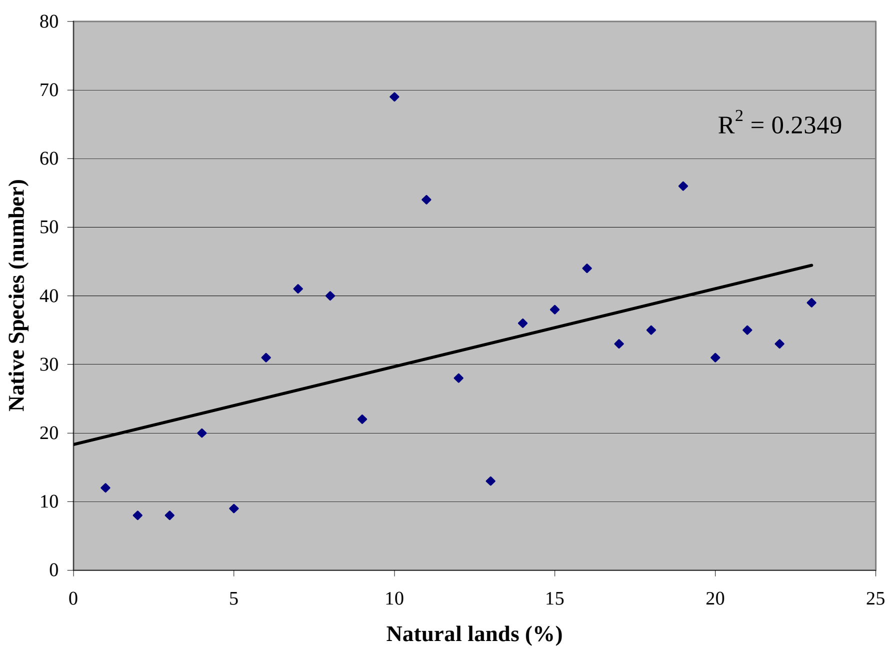

Figure 8. Relationship of native species numbers to the amount of natural lands.

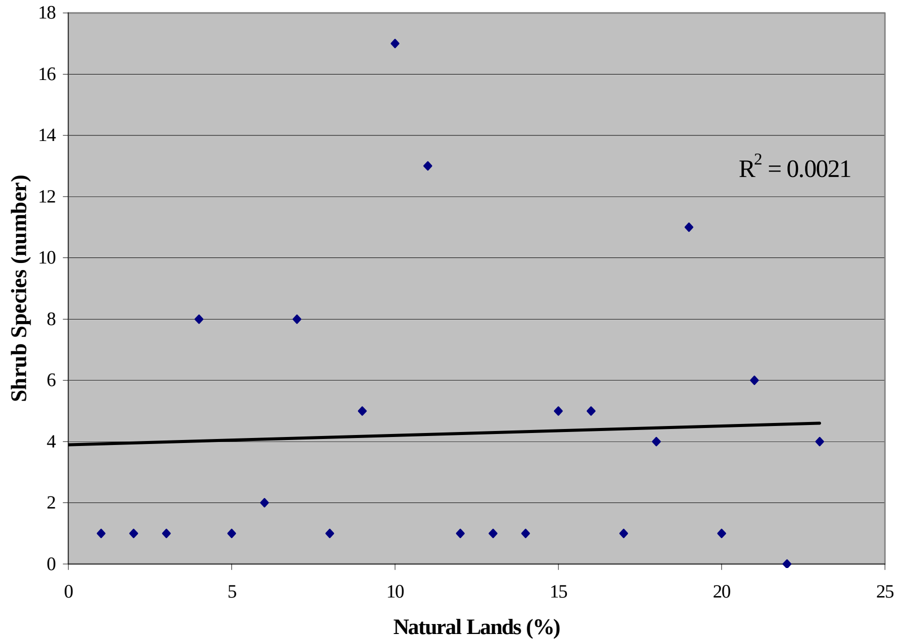

Figure 9. Relationship of shrub species numbers to the amount of natural lands.

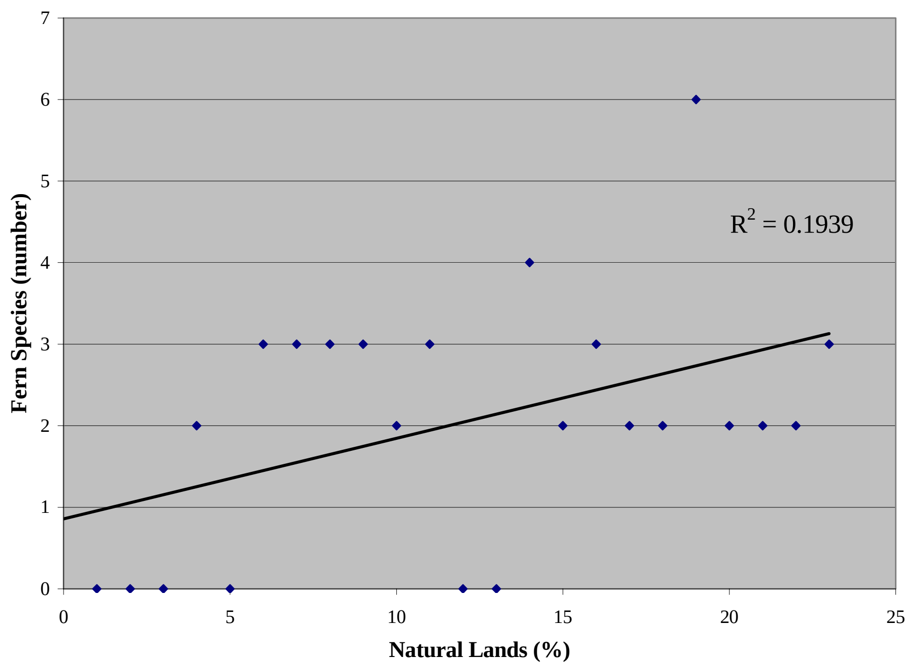

Figure 10. Relationship of fern species numbers to the amount of natural lands.

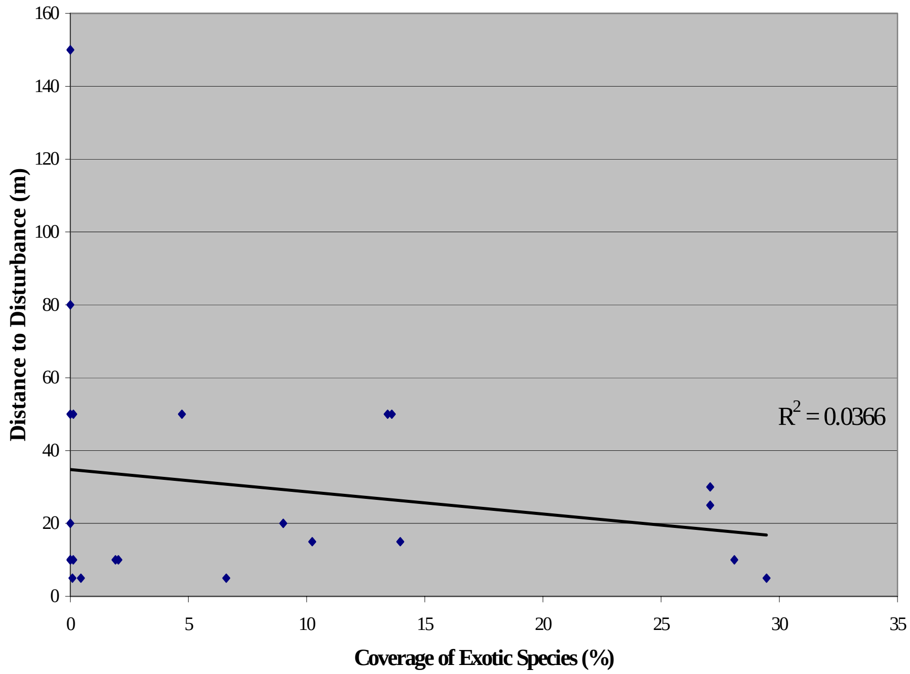

Figure 11. Relationship of distance to disturbance to the coverage of exotic plant species.

to 150 meters. However, there also appeared to be no strong relationship between disturbance distance and the coverage of exotic plants at a site (R^2 = 0.0366).

Finally, Floristic Quality Indices (FQI), based on establishing conservatism values for all species at a site has been suggested as a good indicator of site quality, as it incorporates all of the vegetation at a site (Herman et al., 1996; Wilhelm and Ladd, 1988). The extremely low R^2 value (0.0101) suggests that FQI scores are not an effective measure of wetland integrity for the inland depressional wetlands that we studied (Figure 12).

Indicators of Wetland Quality—Single-Plot Analysis.

The analyses by site were followed by investigation of the correlation between land use and the vegetation of individual transects. For some sites such as Harr Road, the land use for individual transects varied greatly. There was little consistent correlation between land use and the number of native species when all forty-five transects were analyzed independently (Figure 13; R^2 = 0.0003). Similarly, the correlation between total exotic plant cover and land use was also low (Figure 14; R^2 = 0.0021).

To better understand the low correlation between land use and vegetation along transects, a table with both land use and vegetation coverage values was created for all sites that had more than one transect (Table 1). For most sites, the land use cover was very similar for all sampling plots. This was not the case for Harr Road (Appendix 1.4), in which one transect has 24.1% agriculture nearby, while the other transect has only 3.5% agriculture. At Harr Road, the transect with more agriculture nearby supports a much greater amount of exotic plant cover, over 50%, which is consistent with expectations. But for the other sites, where land cover values are similar for all individual plots, exotic plant coverage differs greatly across plots for nine of eleven sites. Large differences in coverage from

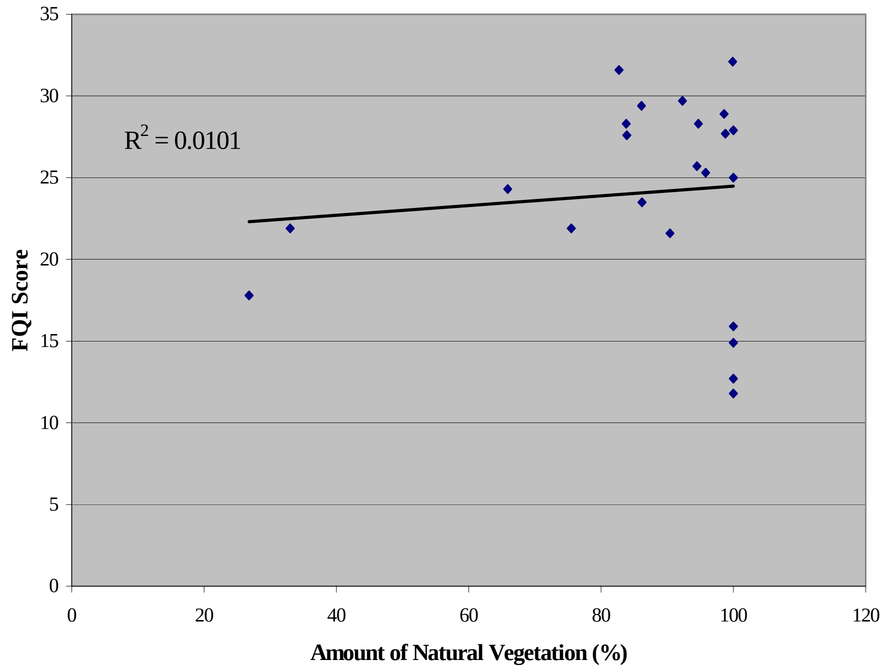

Figure 12. Relationship of FQI to the amount of natural lands.

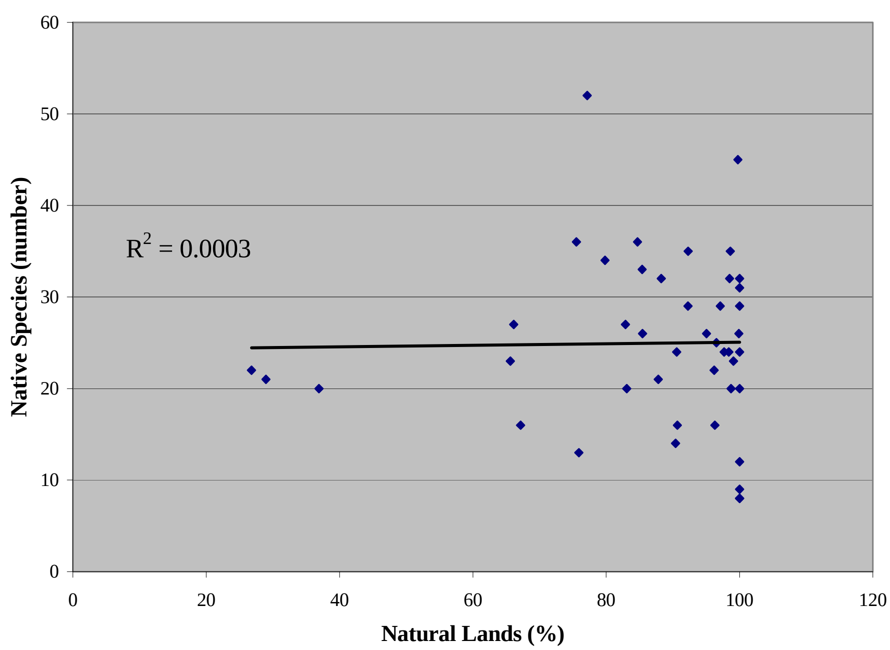

Figure 13. Relationship of native species numbers to the amount of natural lands in all 45 transects at 23 sites.

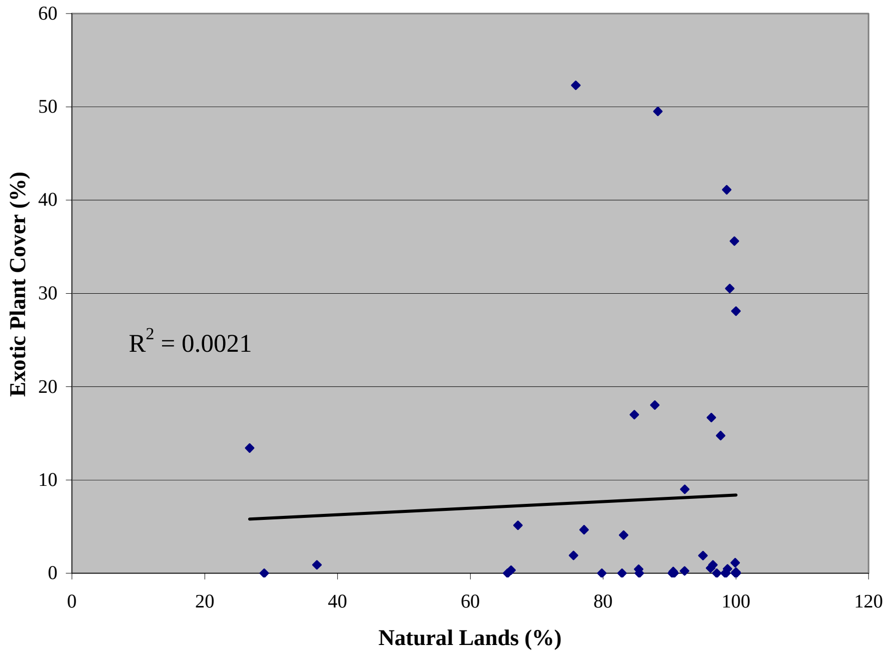

Figure 14. Relationship of exotic plant cover to the amount of natural lands in all 45 transects at 23 sites.

Table 1. Comparison of vegetation variables at sites with more than one sampling transect.

SITE_TRANSECT	Agriculture (%)	Urban (%)	Forest + Water (%)	Graminoids	Forbs	Ferns	Shrubs	Total Native	Exotic Cover
Cassidy_1	1.3	0.0	98.7	7	13	0	0	20	0.5
Cassidy_2	2.3	0.0	97.7	8	15	1	0	24	14.8
Cassidy_3	0.0	0.0	100.0	9	13	2	0	24	0.0
Embury East_1	0.1	0.0	99.9	5	18	2	1	26	1.1
Embury East_2	0.9	0.0	99.1	7	11	2	3	23	30.5
Harr_1	24.1	0.0	75.9	3	8	2	0	13	52.3
Harr_2	3.5	0.0	96.5	2	21	1	1	25	0.9
Huron Swamp_1	6.1	8.5	85.4	3	20	3	6	33	0.4
Huron Swamp_2	2.0	7.3	90.7	1	9	4	2	16	0.0
Huron Swamp_3	4.7	12.4	82.9	4	12	4	6	27	0.0
Huron Swamp_4	2.1	12.4	85.5	4	15	2	5	26	0.0
Leeke_1	4.9	0.0	95.1	6	17	2	1	26	1.9
Leeke_2	3.7	0.0	96.3	5	8	2	1	16	16.7
Leeke_3	3.8	0.0	96.2	4	16	2	0	22	0.6
Livingston_1	0.0	1.5	98.5	4	22	2	4	32	0.0
Livingston_2	0.0	1.4	98.6	8	23	3	1	35	41.1
Maute_1	32.4	1.5	66.1	2	21	4	0	27	0.3
Maute_2	32.5	1.9	65.6	2	16	4	1	23	0.0
Maute_3	30.5	2.3	67.2	4	11	1	0	16	5.1
Rank Road_1	69.2	1.8	29.0	11	10	0	0	21	0.0
Rank Road_2	63.1	0.0	36.9	8	11	0	1	20	0.9
Teeple Lake_1	0.0	0.0	100.0	4	18	2	6	31	0.1
Teeple Lake_2	0.0	0.2	99.8	6	27	3	9	45	35.6
Thread Creek_1	0.0	22.8	77.2	7	28	2	13	52	4.7
Thread Creek_2	0.0	11.8	88.2	5	19	2	6	32	49.5
Waterbury_1	2.0	14.9	83.1	2	12	2	4	20	4.1
Waterbury_2	1.5	13.8	84.7	4	22	3	7	36	17.0
Waterloo-Munith_1	9.4	2.8	87.8	4	16	0	1	21	18.0
Waterloo-Munith_2	15.8	4.4	79.8	8	23	3	0	34	0.0

plot to plot at a site can also be seen for graminoids, forms, shrubs, and total flora. Thus consistent relationships between land use and vegetation does not occur in most wetland sampling sites.

SUMMARY AND CONCLUSIONS

Regional Wetland Differences

Regional differences exist in southern MI's non-forested wetlands. The wetlands on the sand plain east of Lake Michigan are generally more acid and have shallower organic soils than those of the Jackson Interlobate. Their native plant diversity is also much lower, with as few as eight or nine species encountered along a transect, which less than half the number found in even the most floristically depauperate wetland in the Jackson Interlobate. The one exception was Nurnberg Bog, a site with thick peat soils, that supported 20 species, more than twice as many species as at the other western sand sites. To maximize the correlations between land use and vegetation response, stratification of the data by ecological region or wetland type is recommended. The present data set was partially re-analyzed without the sites from near Lake Michigan. While the difference was only minimal for graminoids, shrubs, total number of native species, and exotic plant cover, the correlations between FQI scores and land use when eliminating the ecologically distinctive Lake Michigan sites raised the R^2 value from 0.0101 to 0.4757, which is a substantial change (Figure 15).

Plant Indicators of Wetland Quality

No effective vegetation indices were found to correlate consistently with land-use. There are several patterns that were noted, but these could result from both natural and human-induced conditions in wetlands.

Shrub Diversity

In earlier studies of the swamp forests of the Jackson Interlobate (Kost, 2001), the number of shrub species present in a forested wetland was one of the strongest indicators identified. Our study did not find shrubs to be an effective indicator for high quality wetlands (Figure 9). There may be several reasons for this, including wetter conditions that are not favorable for many shrub species. Probably a more important question is whether increased numbers or coverage of shrub species indicates a higher quality wetland with less human disturbance. In herbaceous wetlands, partial drainage of the wetland may actually increase the diversity and cover of shrub species. In our study, one of the sites with the greatest diversity of shrubs is Thread Creek, where adjacent gravel mining appears to have dried out the wetland (Appendices 1.14 and 2.14). Drier than original conditions may be responsible for the high number (14) of shrub species and their relatively high coverage (22.2%). There are also two exotic shrub species at the site, *Elaeagnus umbellata* (autumn-olive) and *Rhamnus frangula* (glossy buckthorn). Autumn-olive is typically considered an upland shrub, but is common throughout the wetland, and glossy buckthorn is known to colonize fens that have been drained. Fire was historically responsible for maintaining open conditions in wetlands, reducing establishment and dominance by both trees and shrubs. Increased shrub cover may be partially the result of fire exclusion from wetlands that are dependant on fire for maintenance of high herbaceous diversity. Thus, shrub number, an important indicator for forested wetland quality, does not appear to be an effective measure in non-forested wetlands.

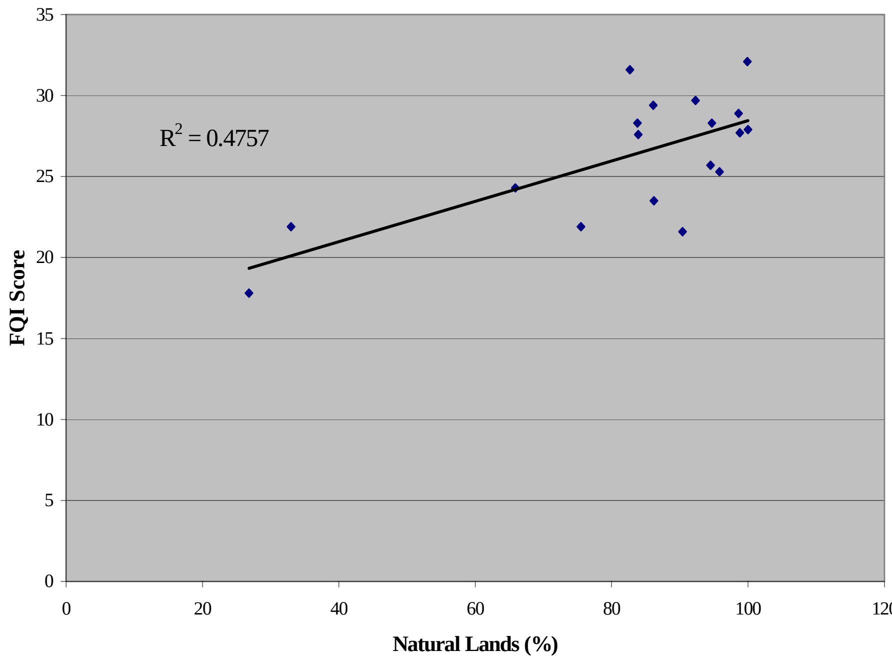

Figure 15. Relationship of FQI to the amount of natural lands in Jackson Interlobate.

Graminoid Diversity

Graminoids include both grasses and grass-like species, such as sedges, rushes, twig-rush, bulrushes, and spike-rushes. Graminoids were considered an important quality indicator for inland depressional wetlands in Minnesota (Gernes and Helgen, 1999), but did not prove to be an effective indicator in Great Lakes coastal wetlands (Albert et al., 2005, in press). In southern Michigan's inland depressional wetlands, graminoids represent several wetland zones. Sedges and grasses generally represent a wet meadow zone, rushes and spike-rushes often represented a moist strand, while bulrushes and twig rush represented an emergent zone. Thus sites with the most sedge diversity typically had a full hydrologic gradient. That said, one of the more manipulated wetlands, Rank Road, supported the meadow graminoids in one transect, with the emergent graminoids in a transect through the center of an old pond. The R^2 values were low, ranging from 0.001 to 0.10, showing little correlation between graminoid diversity and land use (no figures included in report).

Forb Diversity

Forb diversity represents the full range of physiognomic conditions. Species represented in this category include meadow, emergent, floating, and submergent species. Because of the diversity of habitats utilized by this group, its diversity best represents the general conditions of the wetland rather than any specific physical conditions. For this reason, forb diversity scores are difficult to interpret. In correlations between land use and forb diversity, R^2 values were low.

Fern Diversity

Fern diversity was relatively low, with the maximum number of fern or fern allies found in a plot being four. The overall number of fern species found was also quite low. Most of the ferns found in our wetlands were also generalists, occupying a range of hydrologic conditions and present in the majority of sites. Because of this combination of low diversity and ubiquitous distribution, correlation between land use and fern diversity was low (Figure 10).

Total Native Species Diversity

Total native species diversity represents the overall health of the wetland, as it includes species utilizing all zones and hydrologic conditions. Several of the largest, most intact wetlands had high native species diversity, but several degraded sites also had high native diversity, resulting in an overall poor correlation between land use and native species diversity (Figures 8 and 13).

Exotic Species Diversity and Cover

Exotic species diversity is often a variable well correlated with land use condition both in and adjacent to wetlands (Albert and Minc, 2004; Albert et al., 2005, in press; Gernes and Helgren, 1999). Unfortunately, exotic species respond to many different types of disturbance, including alterations of hydrology, alterations of ecological gradient, exposure of sediment, and chemical changes. Many exotics establish after a physical perturbation, but their tolerance to ongoing changes in hydrologic conditions vary greatly. Purple loosestrife, narrow-leaved cattail, and reed canary grass all establish on moist soil, but all are able to grow in a broad range of hydrologic conditions, from moist to flooded. Still other exotics establish when the wetland is drained or ditched to create drier than normal conditions; these include autumn-olive and glossy buckthorn. Correlation of exotic species diversity or coverage to broad land-use classes is weak (Figures 5-7, 11, and 14). To be effective indicators, individual or sub-groups of exotic species will need to be linked to more specific types of wetland disturbance. The number of exotic species encountered in the project was relatively low, with only five common exotics.

Sampling Protocol

To develop a sampling protocol that is more effective, there may be additional steps required. An individual wetland may have undergone a series of management activities over many years. Having a better sense of the spatial history of manipulation may allow for much more accurate evaluation of the effects of different kinds of management. This may require looking at the entire available sequence of historic photos of a site or group of related sites. In most of Michigan, such photo sequences allow the chronology of alterations to be viewed every ten to twenty years. An early manipulation may be almost invisible on a contemporary photo, but the vegetative changes may remain quite significant and may seem without cause without historic context. For example, reed canary grass may only be a pest in wetlands where it was planted as part of the agricultural management. At Harr Road (Appendices 1.4 and 2.4), reed canary grass is only common in transect 1, where it is present in 100 percent of plots with 52% mean coverage. This transect was ditched, a common historic management technique in poorly drained sites, and possibly planted with reed canary grass. In nearby transect 2, which starts immediately adjacent to the plowed wetland, there is only low coverage of reed canary grass. This may indicate that this species does not effectively invade a wetland unless the wetland is first disturbed by drainage and/or plowing.

Hydrologic manipulations that often result in introduction of weeds, like purple loosestrife and narrow leaved cattail, may have important, but spatially-restricted, impact in some wetlands. This was well demonstrated at Leeke Road (Appendices 1.7 and 2.7), where the level of purple loosestrife is much higher in transect 2, which crosses a ditch, than it is in two nearby unditched transects. To measure this degree of variability, much more detailed photo interpretation and ground mapping may be required to accurately document the relationship of land use to wetland change. In a large wetland with several different management events or activities, several individual transects or clusters of sampling plots may be needed to correlate a vegetation response to its real cause. Unfortunately, this detailed level of investigation counters some of the purposes for developing biotic indicators of degradation—speed and reduced expense.

Multiple wetland alterations within a single wetland can result in very different vegetation responses. Thread Creek (Appendix 1.14) in Oakland County is a classic example. Along its lower margin, the wetland is partially dammed, resulting in relatively low shrub cover and diversity, along with high coverage of narrow-leaved cattail, a species that thrives on flooded conditions. In contrast, at the upper margin of the wetland, gravel mining appears to have dried out the wetland, resulting in increased plant diversity (53 species vs. 34 in wet end), including 13 species of shrubs. Exotic species characteristic of drier conditions, including reed canary grass and autumn olive, are common along this dried-down transect. Thus, the location of multiple transects within a wetland can provide very different perspectives on the wetland's level of degradation.

Localized hydrologic variability may also reduce the effectiveness of plant indicators. It was noticed that transects that began close to a steep wetland margin and then ran perpendicular to the hydrologic gradient often had much higher native plant diversity than a transect located near the center of a wetland. Transects that only cross the wetland center typically lack the full range of hydrologic conditions and should be avoided if a single transect is meant to characterize the entire wetland.

Ponds have been dug in many wetlands. Ponds often continue to support wetland vegetation, but with a loss of shrub and fern diversity. In the sites visited during this study (M59, Appendices 1.9 and 2.9, and Rank Road, Appendices 1.12 and 2.12), ponds did not result in establishment of either exotic plants, like purple loosestrife, nor aggressive native plants, like narrow-leaved cattail. However, the authors have seen other wetlands with ponds that are overrun with these exotics, so further research is needed to document the results of creating ponds within wetland complexes.

In summary, the sampling and analysis conducted in this study did not provide us with a clear understanding of the relationship of specific land use activities to vegetation response. This lack of clear relationships between management history and vegetation response is likely the result of 1) not linking the sampling scale to the scale of the disturbance events, 2) complex hydrologic conditions that do not allow the vegetation of an entire wetland to be characterized by a single transect, and 3) a sequence of historic disturbance events that may not be interpretable from a single photograph, but which may require evaluation of the longer disturbance history of the wetland. Furthermore, a detailed literature review may be required to identify plant indicators based on documented relationships between specific plants and the activities that allowed these species to establish and persist at a site.

ACKNOWLEDGEMENTS

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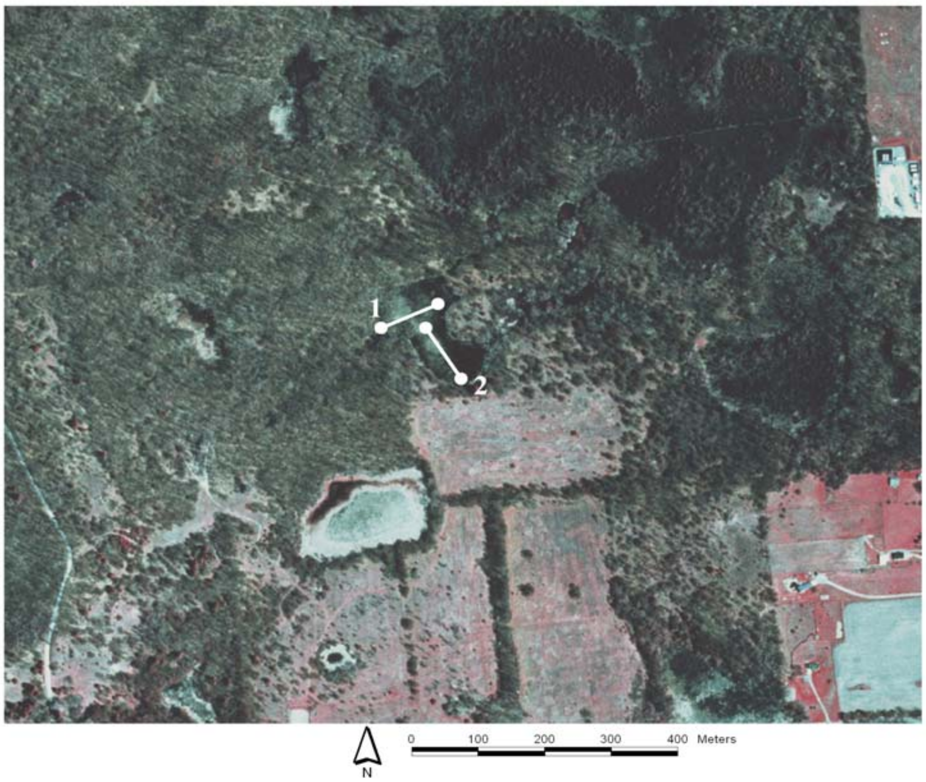
APPENDICES

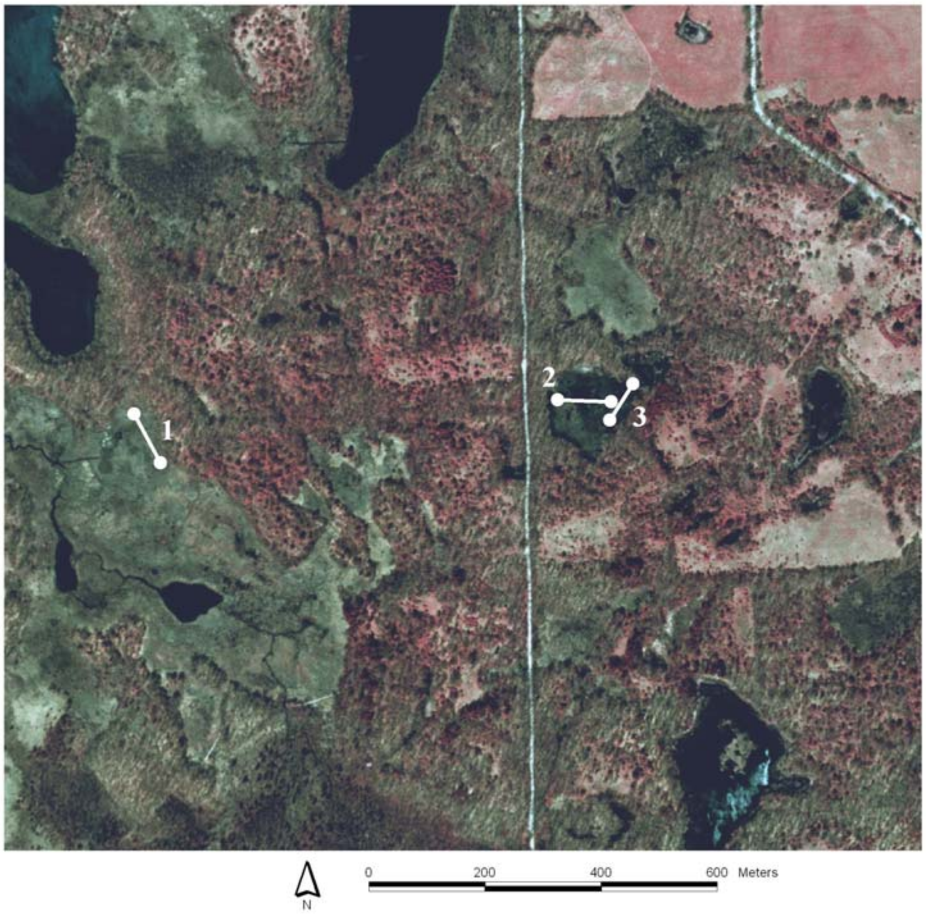
Appendix 1. Aerial Photographs and Topographic Maps for Sampling Sites

Appendix 1.1 Beaumont Aerial Photo

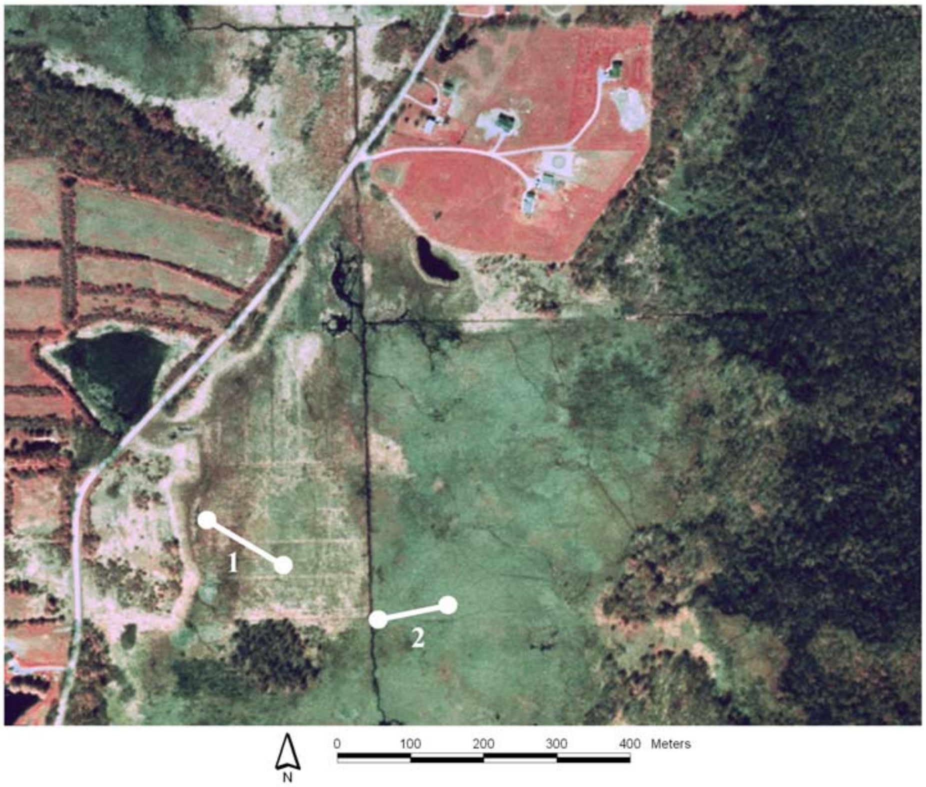


Appendix 1.2 Cassidy Road Aerial Photo

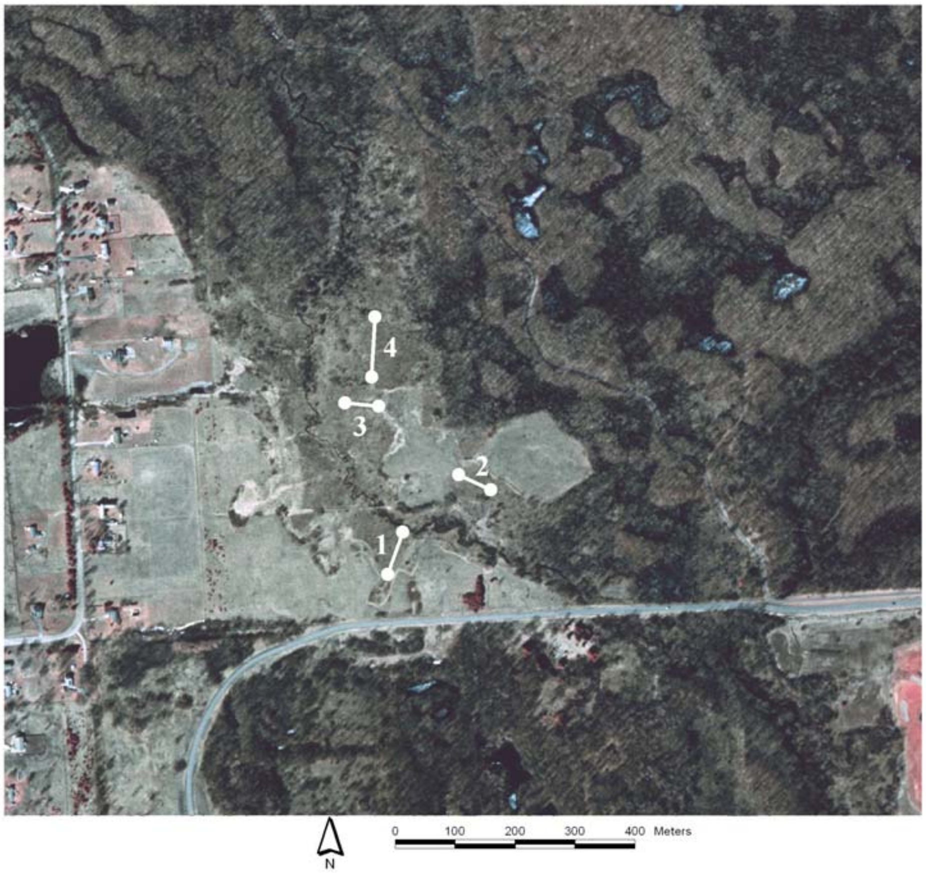
Appendix 1.3 Emery Road Aerial Photo



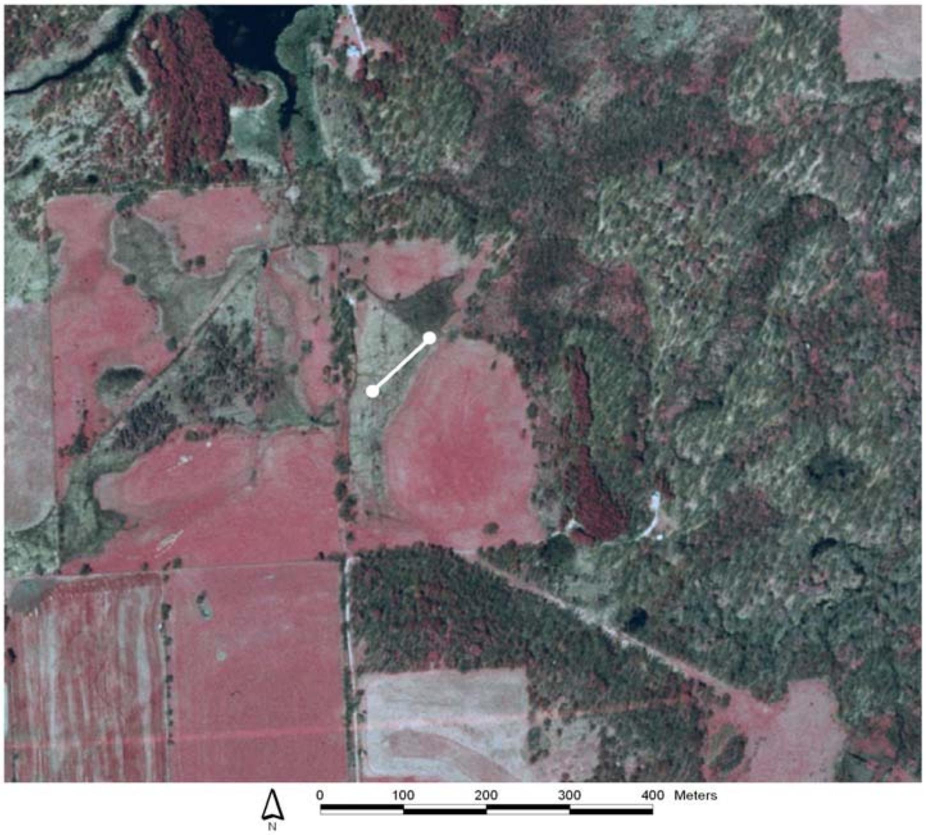
Appendix 1.4 Harr Road Aerial Photo



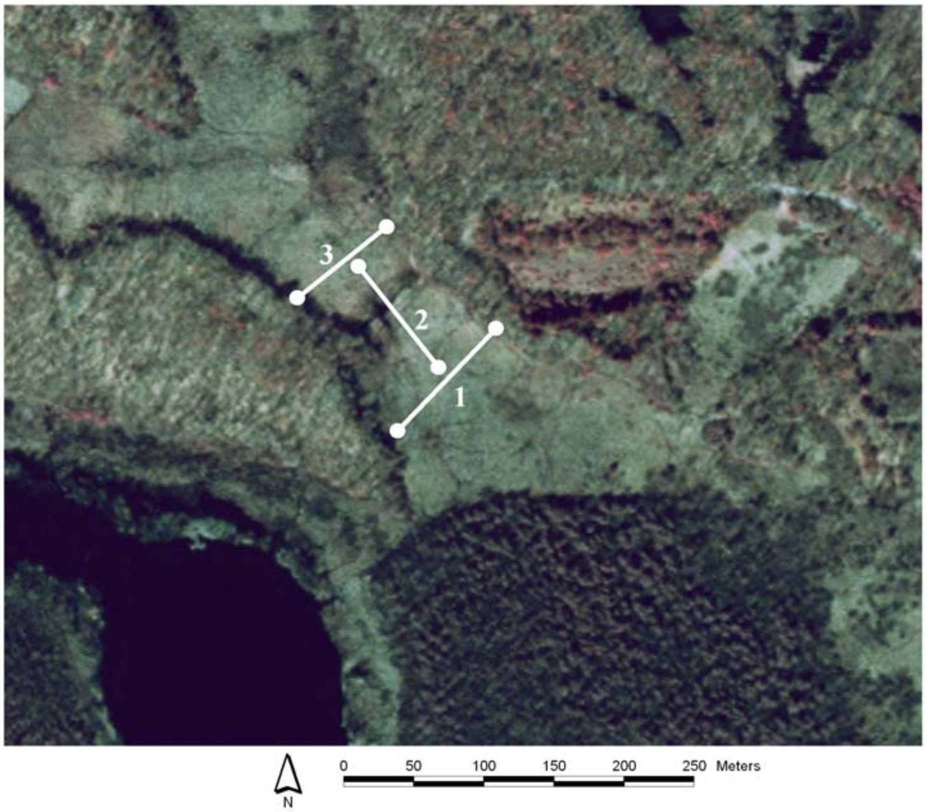
Appendix 1.5 Huron Meadow Aerial Photo



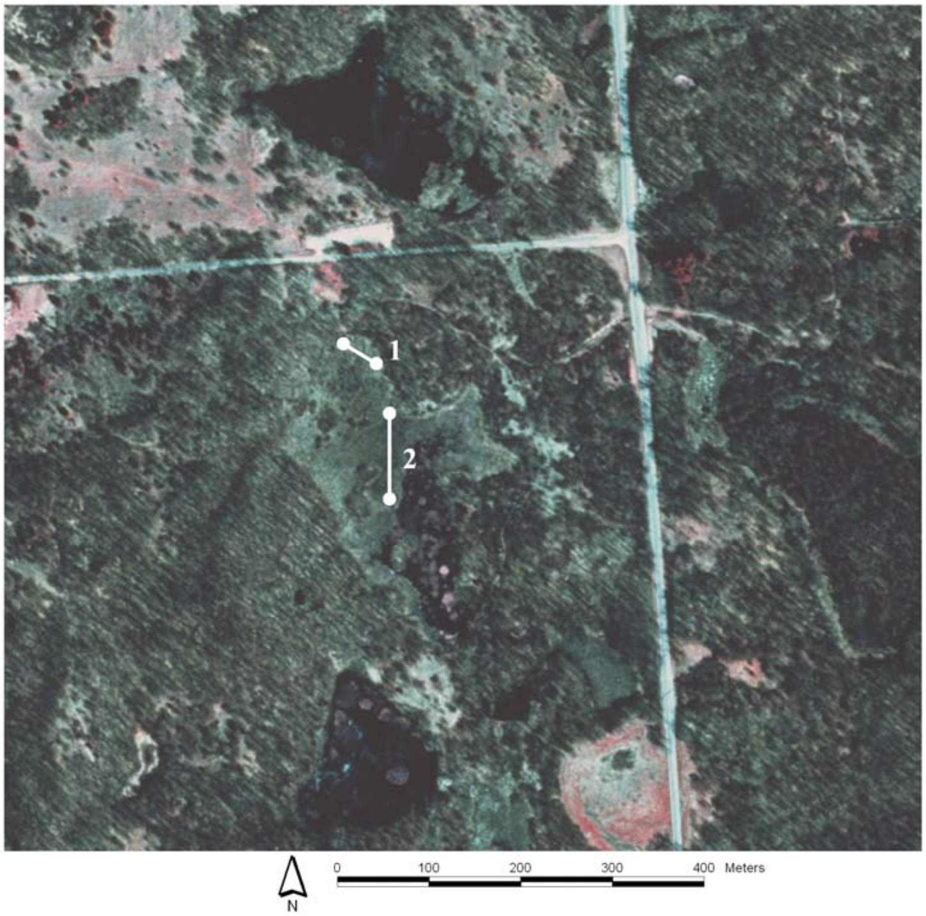
Appendix 1.6 Irwin's Road Aerial Photo



Appendix 1.7 Leeke Road Aerial Photo



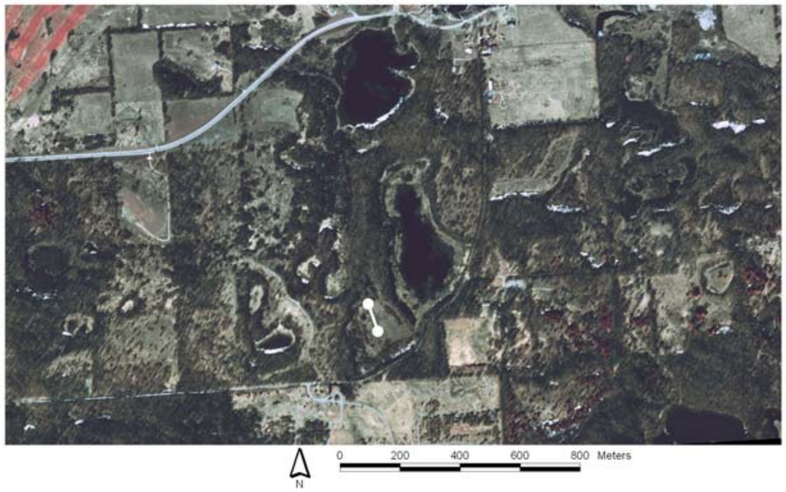
Appendix 1.8 Livingston Road Aerial Photo



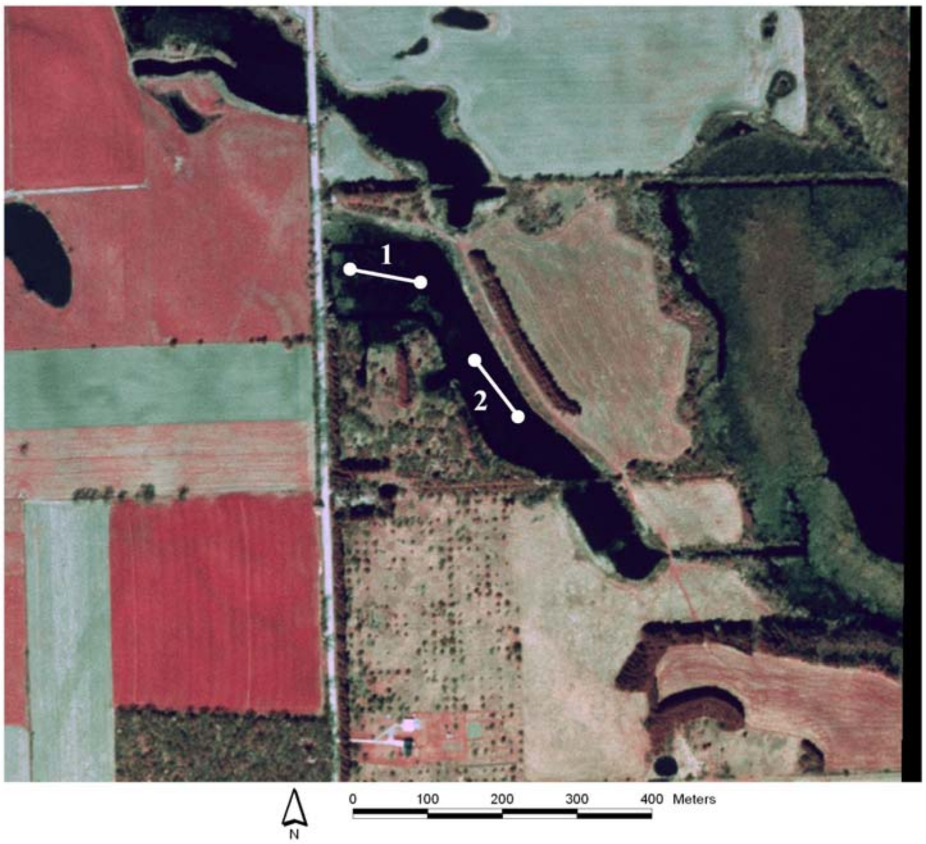
Appendix 1.9 M-59 Aerial Photo

Appendix 1.10 Maute Road Aerial Photo

Appendix 1.11 Orr Road Aerial Photo

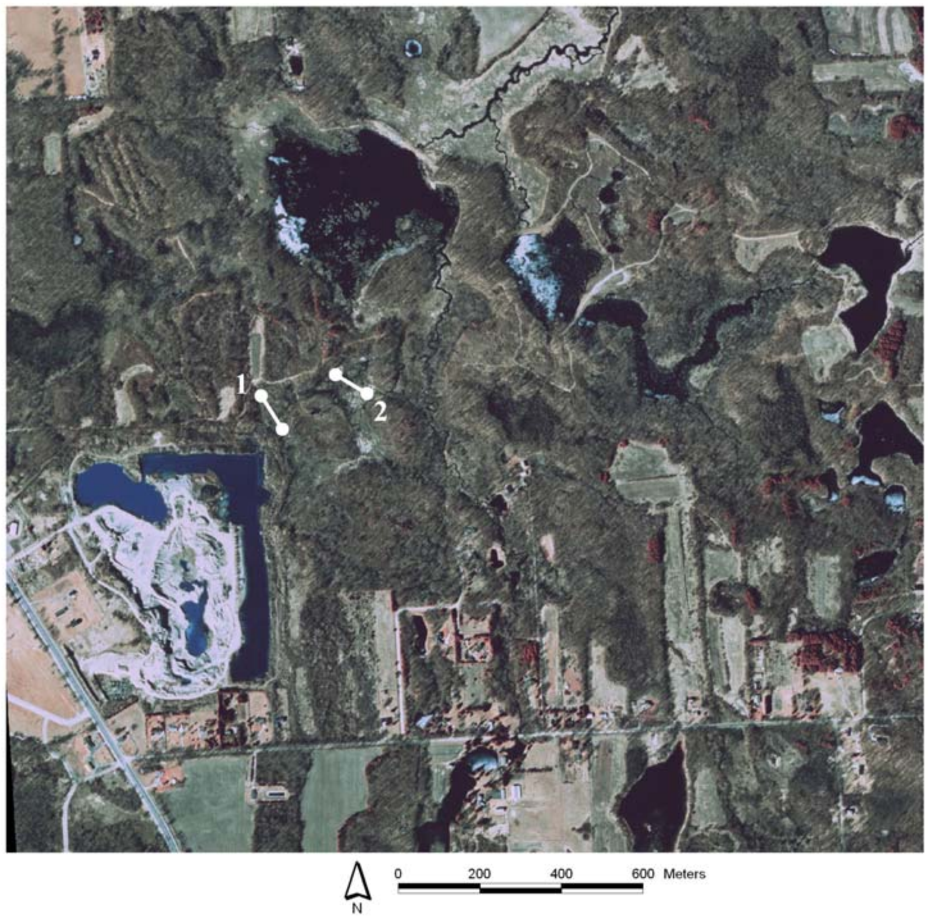


Appendix 1.12 Rank Road Aerial Photo



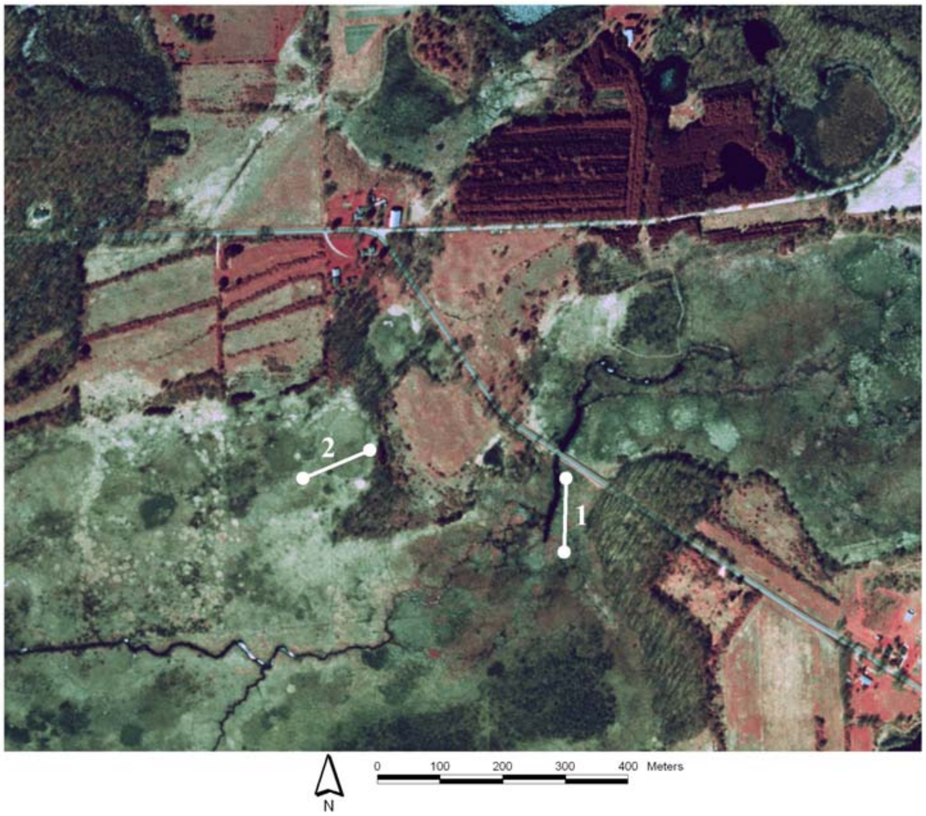
Appendix 1.13 Teeple Lake Aerial Photo

Appendix 1.14 Thread Creek Aerial Photo

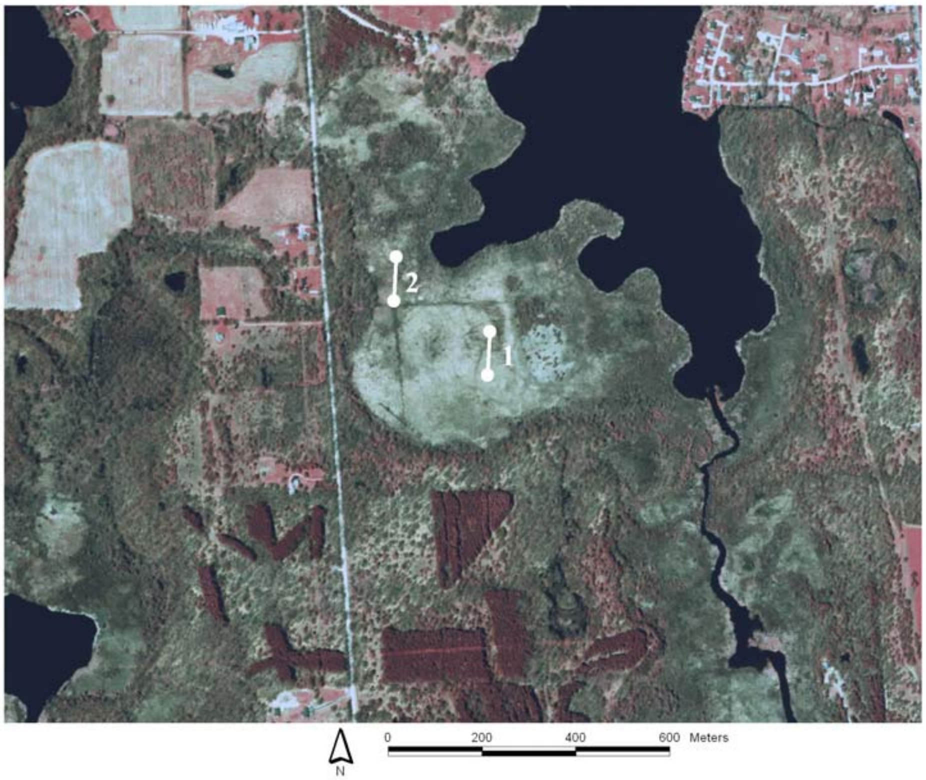


Appendix 1.15 Waterbury Aerial Photo

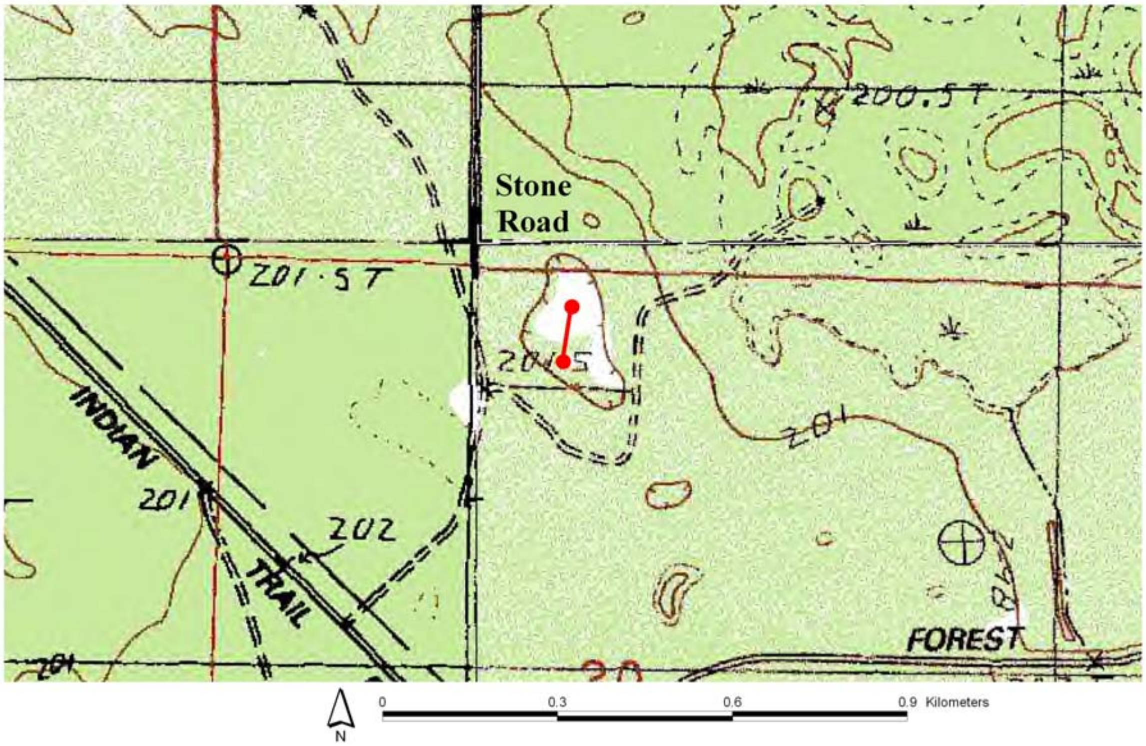
Appendix 1.16 Waterloo-Munith Aerial Photo



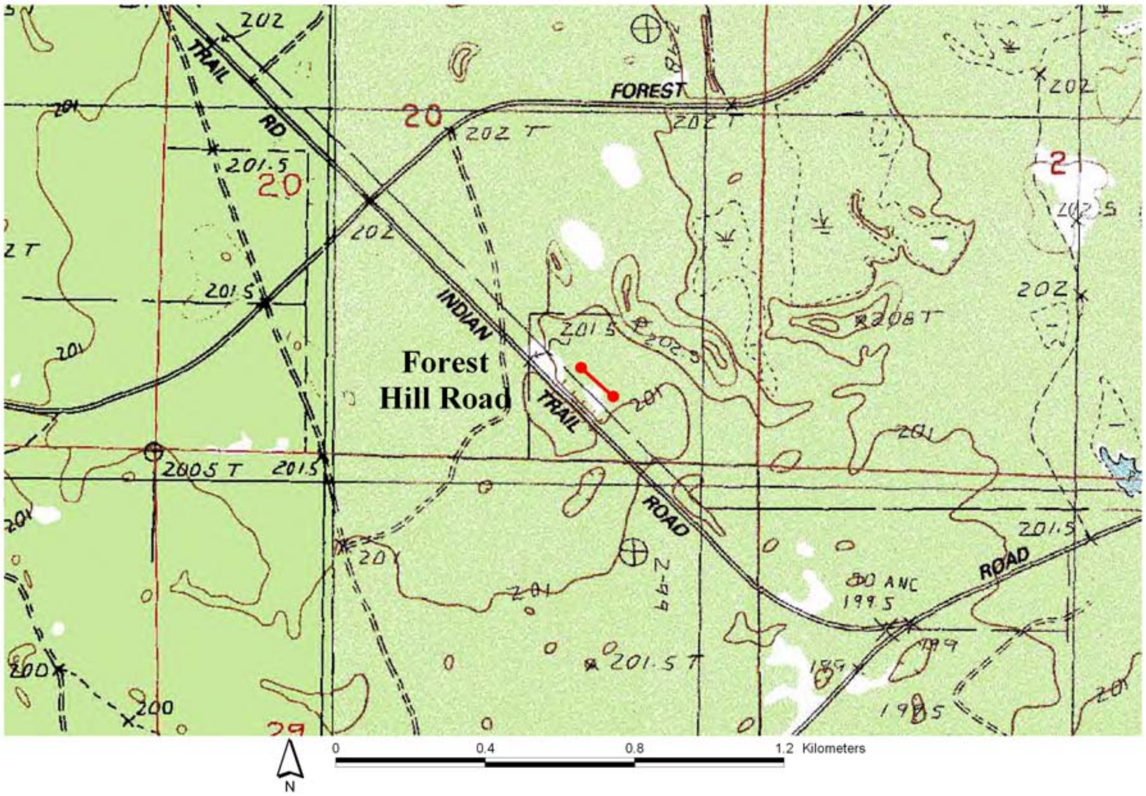
Appendix 1.17 Williamsville Aerial Photo



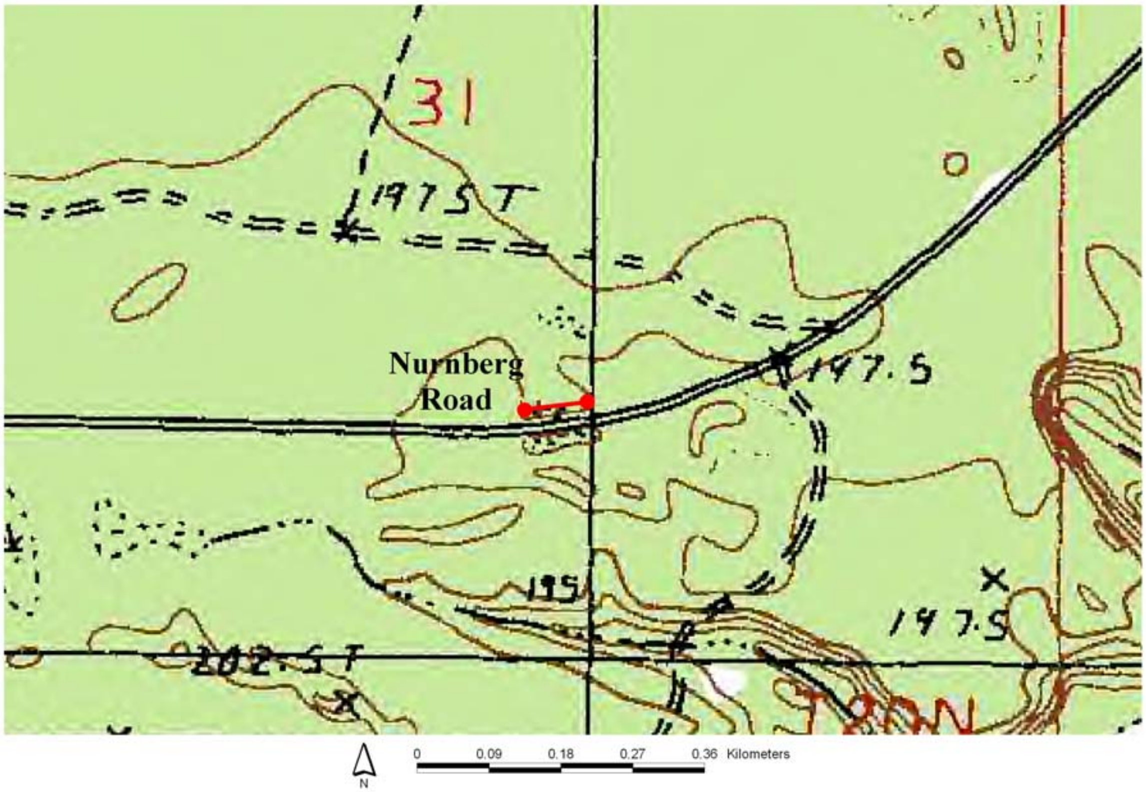
Appendix 1.18 Stone Road Topographic Map



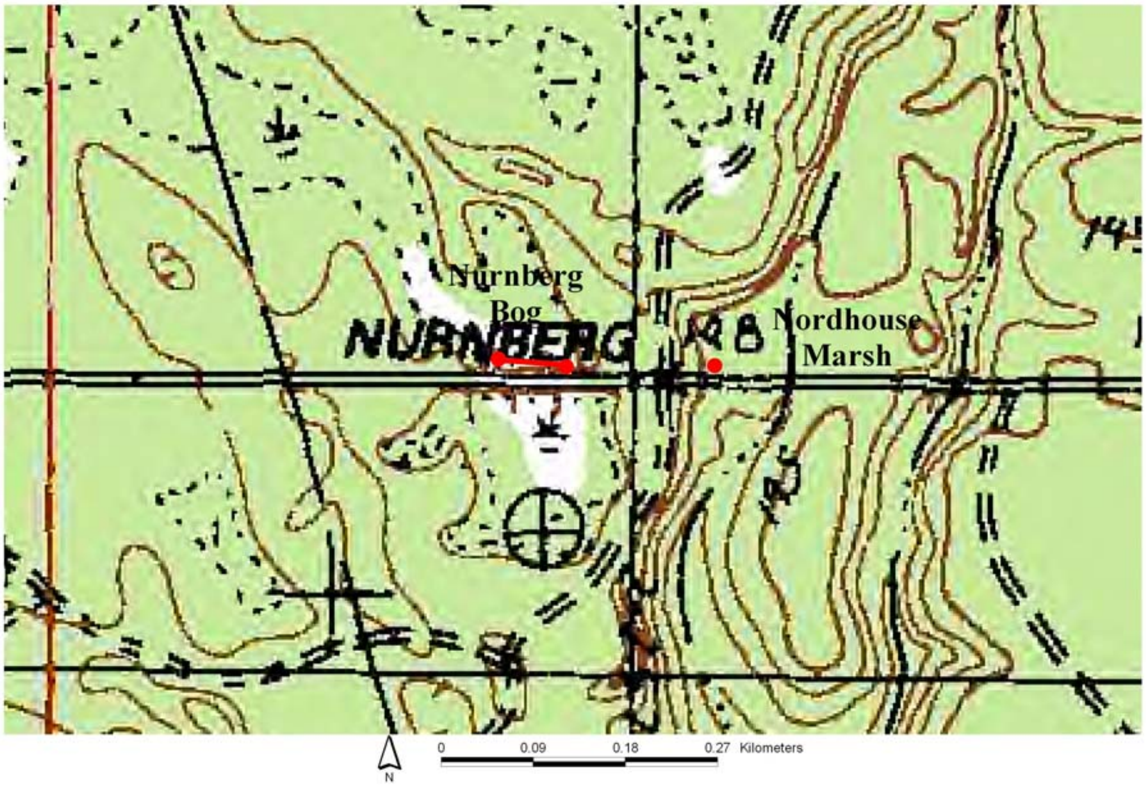
Appendix 1.19 Forest Hill Road Topographic Map



Appendix 1.20 Nurnberg Road Topographic Map



Appendix 1.21-22 Nurnberg Bog and Nordhouse Marsh Topographic Map



Appendix 2. Vegetation Summary for Sampling Sites

Appendix 2.1 Beaumont Vegetation Summary

Beaumont				
	Transect 1		**Transect 2**	**Total**
	length = 95 m		length = 95 m	length = 190 m
Species	(n = 20)		(n = 20)	(n = 40)
Graminoids				
Calamagrostis canadensis	20 (0.20)		15 (2.50)	18 (1.35)
Carex comosa	10 (0.10)		10 (0.10)	10 (0.10)
Carex diandra	--		20 (0.20)	10 (0.10)
Carex hystericina	5 (0.03)		20 (0.28)	13 (0.15)
Carex lacustris	20 (3.75)		--	10 (1.88)
Carex lasiocarpa	25 (1.65)		50 (24.45)	38 (13.05)
Carex stricta	70 (15.83)		65 (4.80)	68 (10.31)
Dulichium arundinacium	35 (1.28)		25 (0.33)	30 (0.80)
Eleocharis erythropoda	70 (6.33)		70 (5.30)	70 (5.81)
Glyceria borealis	5 (0.03)		20 (0.15)	13 (0.09)
Leersia oryzoides	20 (0.20)		30 (0.20)	25 (0.20)
Scirpus validus	--		30 (0.50)	15 (0.25)
Forbs				
Asclepias incarnata	--		5 (0.30)	3 (0.15)
Bidens coronatus	5 (0.03)		10 (0.05)	8 (0.04)
Campanula aparinoides	10 (0.05)		25 (0.13)	18 (0.09)
Cicuta bulbifera	60 (0.50)		90 (0.50)	75 (0.50)
Eupatorium perfoliatum	30 (1.20)		--	15 (0.60)
Galium tinctorium	20 (0.10)		45 (0.23)	33 (0.16)
Lemna minor	--		5 (0.03)	3 (0.01)
Lemna trisulca	--		15 (0.13)	8 (0.06)
Lycopus uniflorus	55 (0.85)		50 (0.35)	53 (0.60)
Lysimachia thyrsiflora	65 (1.00)		80 (1.73)	73 (1.36)
Pilea pumila	5 (0.30)		--	3 (0.15)
Polygonum amphibium	45 (0.63)		--	23 (0.31)
Potentilla palustris	65 (1.90)		5 (0.08)	35 (0.99)
Rumex orbiculata	--		5 (0.03)	3 (0.01)
Sagittaria latifolia	95 (1.80)		95 (2.70)	95 (2.25)
Scutellaria galericulata	45 (0.75)		45 (0.55)	45 (0.65)
Sparganium eurycarpum	--		5 (0.15)	3 (0.08)
Triadenum fraseri	40 (0.43)		15 (0.08)	28 (0.25)
Typha latifolia	65 (2.03)		30 (1.03)	48 (1.53)
Viola sp.	5 (0.15)		--	3 (0.08)
Erechtites hieracifolia	10 (0.10)		--	5 (0.05)
Ferns				
Equisetum arvense	5 (0.03)		--	3 (0.01)
Onoclea sensibilis	--		5 (0.15)	3 (0.08)
Thelypteris palustris	50 (2.88)		5 (0.08)	28 (1.48)
Shrubs				
Betula pumila	5 (1.20)		--	3 (0.60)

Appendix 2.2 Cassidy Road Vegetation Summary

Cassidy								
	Transect 1		**Transect 2**		**Transect 3**		**Total**	
	length = 120 m		length = 95 m		length = 95		length = 310 m	
Species	(n = 25)		(n = 20)		(n = 20)		(n = 65)	
Graminoids								
Bromus ciliatus	12	(0.14)		--		--	5	(0.05)
Calamagrostis canadensis	80	(6.30)	60	(4.43)	5	(0.15)	51	(3.83)
Carex bebbii		--	10	(0.15)		--	3	(0.05)
Carex comosa		--	10	(0.05)	45	(2.05)	17	(0.65)
Carex diandra	20	(0.18)		--		--	8	(0.07)
Carex hystericina		--	5	(0.08)	10	(0.05)	5	(0.04)
Carex lacustris		--	40	(0.90)		--	12	(0.28)
Carex lasiocarpa	100	(21.36)	50	(1.50)	80	(6.98)	78	(10.82)
Carex sartwellii	4	(0.06)		--		--	2	(0.02)
Carex stricta		--		--	20	(0.83)	6	(0.25)
Dulichium arundinacium	48	(0.70)		--	10	(0.10)	22	(0.30)
Eleocharis erythropoda	96	(5.54)	80	(1.10)	95	(12.60)	91	(6.35)
Leersia oryzoides		--		--	25	(0.70)	8	(0.22)
Phalaris arundinacea	4	(0.48)	55	(4.55)		--	18	(1.58)
Scirpus validus		--	5	(0.03)		--	2	(0.01)
Eleocharis acicularis		--		--	20	(0.15)	6	(0.05)
Forbs								
Bidens coronatus	12	(0.10)	10	(0.05)	50	(0.30)	23	(0.15)
Bidens frondusus		--	40	(2.13)		--	12	(0.65)
Campanula aparinoides	68	(0.60)	10	(0.05)	5	(0.03)	31	(0.25)
Cicuta bulbifera	20	(0.14)	60	(0.35)	10	(0.05)	29	(0.18)
Epilobium leptophyllum	32	(0.20)		--	10	(0.05)	15	(0.09)
Galium tinctorium	88	(1.08)	50	(0.25)	75	(0.48)	72	(0.64)
Lycopus americanus		--	50	(0.45)	25	(0.13)	23	(0.18)
Lycopus uniflorus	80	(1.82)	30	(0.30)	55	(2.00)	57	(1.41)
Lysimachia thyrsiflora	68	(0.62)	10	(0.05)	10	(0.18)	32	(0.31)
Lythrum salicaria		--	70	(10.20)		--	22	(3.14)
Pilea pumila		--	5	(0.03)		--	2	(0.01)
Polygonum amphibium	28	(0.30)	10	(0.05)	30	(0.25)	23	(0.21)
Potentilla palustris	20	(0.38)	10	(0.10)	10	(0.05)	14	(0.19)
Rumex orbiculata	64	(1.88)	40	(0.78)	5	(0.08)	38	(0.98)
Sagittaria latifolia	100	(7.08)	95	(2.40)	100	(3.08)	98	(4.41)
Scutellaria galericulata	44	(0.46)		--	25	(0.40)	25	(0.30)
Sparganium eurycarpum		--	5	(0.15)		--	2	(0.05)
Typha latifolia	32	(2.12)	100	(6.80)	80	(3.43)	68	(3.96)
Ferns								
Equisetum fluviatile		--		--	15	(0.13)	5	(0.04)
Thelypteris palustris		--	10	(0.45)	10	(0.45)	6	(0.28)
Non-Plant Coverage								
Water coverage		--	55	(12.25)	10	(0.60)	20	(3.95)

Appendix 2.3 Emery Road Vegetation Summary

	Embury West		Embury East					
	Transect 1 length = 95 m (n = 20)		Transect 1 length = 95 m (n = 20)		Transect 2 length = 70 m (n = 15)		Total length = 165 (n = 35)	
Graminoids								
Calamagrostis canadensis	20	(0.10)	25	(4.38)	20	(0.80)	23	(2.59)
Carex aquatilis	20	(0.25)		--		--		--
Carex comosa		--	20	(0.15)	33	(0.47)	27	(0.31)
Carex hystericina		--	5	(0.03)	13	(0.13)	9.2	(0.08)
Carex lacustris		--	40	(13.80)	7	(0.10)	23	(6.95)
Carex lasiocarpa	45	(8.18)	60	(12.60)	27	(0.50)	43	(6.55)
Carex sartwellii	5	(0.03)		--	7	(0.10)	3.3	(0.05)
Carex stricta	85	(19.98)		--	13	(1.63)	6.7	(0.82)
Leersia oryzoides	15	(0.08)		--		--		--
Phalaris arundinacea		--	45	(1.13)	100	(30.13)	73	(15.63)
Forbs								
Aster puniceus	5	(0.03)		--		--		--
Bidens coronatus	50	(0.25)	5	(0.03)		--	2.5	(0.01)
Bidens frondusus		--	25	(0.18)	53	(0.27)	39	(0.22)
Campanula aparinoides	80	(0.40)		--		--		--
Cicuta bulbifera	30	(0.15)	25	(0.13)	60	(0.30)	43	(0.21)
Epilobium leptophyllum	20	(0.10)		--		--		--
Eupatorium maculatum	75	(1.28)	5	(0.03)		--	2.5	(0.01)
Eupatorium perfoliatum	5	(0.03)		--		--		--
Galium tinctorium	85	(0.43)	85	(1.23)	40	(0.33)	63	(0.78)
Impatiens capensis	15	(0.13)		--		--		--
Iris virginica	5	(0.30)		--		--		--
Lemna minor	25	(0.38)		--		--		--
Lycopus americanus		--	35	(0.23)	20	(0.17)	28	(0.20)
Lycopus uniflorus	65	(0.53)	40	(0.25)	47	(0.37)	43	(0.31)
Lysimachia thyrsiflora	85	(0.73)	30	(0.20)	13	(0.20)	22	(0.20)
Lythrum salicaria	90	(9.00)		--		--		--
Mentha arvensis		--	15	(0.38)	7	(0.10)	11	(0.24)
Menyanthes trifoliata		--	10	(0.10)		--	5	(0.05)
Mitella nuda		--	5	(0.03)		--	2.5	(0.01)
Pilea pumila	25	(0.45)		--		--		--
Polygonum amphibium	35	(0.33)	35	(0.48)	53	(0.90)	44	(0.69)
Potentilla palustris		--	35	(0.93)		--	18	(0.46)
Proserpinaca palustris	10	(0.18)		--		--		--
Rumex orbiculata	20	(0.30)	10	(0.33)		--	5	(0.16)
Sagittaria latifolia		--	100	(3.83)	100	(3.30)	100	(3.56)
Scutellaria galericulata	25	(0.13)	20	(0.33)	7	(0.03)	13	(0.18)
Scutellaria lateriflora	5	(0.03)		--		--		--
Sium suave		--	10	(0.05)		--	5	(0.03)

Appendix 2.3 Emery Road Vegetation Summary, Continued

	Embury West		Embury East					
	Transect 1		Transect 1		Transect 2		Total	
	length = 95 m		length = 95 m		length = 70 m		length = 165	
	(n = 20)		(n = 20)		(n = 15)		(n = 35)	
Ferns								
Equisetum fluviatile	5	(0.03)	5	(0.03)		--	2.5	(0.01)
Onoclea sensibilis		--		--	7	(0.10)	3.3	(0.05)
Thelypteris palustris	45	(3.08)	10	(0.18)	7	(0.10)	8.3	(0.14)
Shrubs								
Betula pumila	5	(0.30)		--		--		--
Cornus stolonifera	15	(0.25)		--		--		--
Salix discolor	35	(3.95)		--	13	(3.30)	6.7	(1.65)
Salix exigua	35	(3.35)	20	(6.40)	20	(8.00)	20	(7.20)
Salix serissima	25	(0.70)		--	20	(1.20)	10	(0.60)
Spiraea alba	15	(0.13)		--		--		--
Non-Plant Coverage								
Water coverage	100	(39.30)		--		--		--
Water depth (cm)	100	(8.95)		#DIV/0!		#DIV/0!		#DIV/0!
Moss	5	(0.60)	10	(0.90)		--	5	(0.45)
# of Cx hummocks	85	(3.15)		--	20	(0.33)	10	(0.17)
Hummock max height (cm)	85	(29.59)		#DIV/0!	20	(21.67)	10	#DIV/0!

Appendix 2.4 Harr Road Vegetation Summary

Species	Transect 1 length = 120 m (n = 25)		Transect 2 length = 95 m (n = 20)		Total length = 215 m (n = 45)	
Graminoids						
Carex comosa		--	10	(0.05)	4	(0.02)
Carex lasiocarpa	44	(12.36)		--	24	(6.87)
Carex sartwellii	4	(0.02)		--	2	(0.01)
Carex stricta	16	(6.00)		--	9	(3.33)
Leersia oryzoides		--	20	(0.70)	9	(0.31)
Phalaris arundinacea	100	(52.32)	5	(0.08)	58	(29.10)
Forbs						
Asclepias incarnata		--	5	(0.08)	2	(0.03)
Aster puniceus		--	30	(0.90)	13	(0.40)
Caltha palustris		--	15	(0.45)	7	(0.20)
Campanula aparinoides	36	(0.18)	10	(0.05)	24	(0.12)
Cicuta bulbifera		--	10	(0.05)	4	(0.02)
Cuscuta gronovii		--	5	(0.03)	2	(0.01)
Epilobium leptophyllum	16	(0.08)	95	(1.65)	51	(0.78)
Eupatorium maculatum		--	70	(2.03)	31	(0.90)
Eupatorium perfoliatum		--	20	(0.53)	9	(0.23)
Galium tinctorium	16	(0.08)	45	(0.23)	29	(0.14)
Impatiens capensis		--	85	(3.93)	38	(1.74)
Iris virginica	20	(0.36)		--	11	(0.20)
Lycopus uniflorus	8	(0.04)	50	(0.75)	27	(0.36)
Lysimachia thyrsiflora		--	60	(1.53)	27	(0.68)
Lythrum salicaria		--	25	(0.75)	11	(0.33)
Mentha arvensis		--	5	(0.03)	2	(0.01)
Pilea pumila		--	95	(3.38)	42	(1.50)
Polygonum amphibium	48	(0.72)	10	(0.23)	31	(0.50)
Polygonum hydropiperoides		--	25	(0.35)	11	(0.16)
Rumex orbiculata		--	5	(0.08)	2	(0.03)
Sagittaria latifolia	36	(1.44)		--	20	(0.80)
Scutellaria galericulata		--	5	(0.08)	2	(0.03)
Solanum dulcamara		--	5	(0.08)	2	(0.03)
Typha latifolia	4	(0.06)	100	(32.70)	47	(14.57)
Viola sp.		--	5	(0.03)	2	(0.01)
Ferns						
Equisetum fluviatile	16	(0.08)		--	9	(0.04)
Thelypteris palustris	4	(0.12)	85	(10.88)	40	(4.90)
Shrubs						
Cornus stolonifera		--	10	(1.20)	4	(0.53)
Non-Plant Coverage						
Moss	4	(0.48)		--	2	(0.27)

Appendix 2.5 Huron Meadow Vegetation Summary

Huron Meadow	Transect 1		Transect 2		Transect 3		Transect 4		Total	
	length = 80 m		length = 60 m		length = 60 m		length = 95 m		length = 295 m	
	(n = 17)		(n = 13)		(n = 13)		(n = 20)		(n = 63)	
Graminoids										
Bromus ciliatus	35	(0.24)		--		--	15	(0.18)	14	(0.12)
Calamagrostis canadensis	29	(0.29)		--	77	(0.69)	70	(0.95)	46	(0.52)
Carex hystericina		--		--	8	(0.04)		--	2	(0.01)
Carex lacustris		--	100	(58.15)	46	(1.04)	90	(26.13)	59	(20.51)
Carex stricta	100	(70.94)		--	100	(51.54)	75	(23.70)	71	(37.30)
Phalaris arundinacea	12	(0.44)		--		--		--	3	(0.12)
Forbs										
Apios americana	12	(0.12)		--		--		--	3	(0.03)
Asclepias incarnata	18	(0.26)		--	8	(0.12)	5	(0.08)	8	(0.12)
Aster borealis	29	(0.50)		--	8	(0.04)		--	10	(0.14)
Aster puniceus	88	(4.41)	8	(0.12)	54	(1.00)	35	(1.00)	48	(1.74)
Campanula aparinoides	53	(0.26)		--		--		--	14	(0.07)
Chelone glabra		--		--	8	(0.04)	5	(0.03)	3	(0.02)
Cicuta bulbifera		--	8	(0.04)		--		--	2	(0.01)
Cicuta maculata	6	(0.18)		--		--		--	2	(0.05)
Eupatorium maculatum	76	(2.47)	54	(1.54)	92	(4.19)	95	(5.40)	81	(3.56)
Eupatorium perfoliatum		--		--	8	(0.12)		--	2	(0.02)
Galium asprellum	24	(0.29)		--		--	65	(0.73)	27	(0.31)
Galium tinctorium		--	23	(0.12)		--	5	(0.03)	6	(0.03)
Geum canadense	6	(0.18)		--		--		--	2	(0.05)
Hypericum sp.	6	(0.03)		--		--	5	(0.03)	3	(0.02)
Impatiens capensis	29	(0.26)		--		--		--	8	(0.07)
Lathyrus palustris		--		--		--	5	(0.03)	2	(0.01)
Lycopus uniflorus	6	(0.03)	8	(0.04)	62	(0.54)	10	(0.10)	19	(0.16)
Lysimachia thyrsiflora		--	38	(0.42)	8	(0.04)	10	(0.10)	13	(0.13)
Mentha arvensis	24	(0.18)		--	8	(0.04)		--	8	(0.06)
Mitella nuda	6	(0.09)		--		--		--	2	(0.02)
Polygonum amphibium	12	(0.18)		--		--		--	3	(0.05)
Pycnanthemum virginianum	18	(0.91)		--		--		--	5	(0.25)
Rubus pubescens	12	(0.12)		--		--	10	(0.10)	6	(0.06)
Scutellaria galericulata		--		--	8	(0.04)		--	2	(0.01)

Appendix 2.5 Huron Meadow Vegetation Summary, Continued.

	Transect 1		Transect 2		Transect 3		Transect 4		Total	
	length = 80 m		length = 60 m		length = 60 m		length = 95 m		length = 295 m	
	(n = 17)		(n = 13)		(n = 13)		(n = 20)		(n = 63)	
Forbs (continued)										
Solidago altissima/canadensis	59	(2.18)		--	69	(2.00)	65	(1.45)	51	(1.46)
Solidago gigantea	12	(0.53)		--		--		--	3	(0.14)
Solidago rugosa		--		--	15	(0.23)	5	(0.03)	5	(0.06)
Sparganium eurycarpum		--	15	(0.58)		--		--	3	(0.12)
Symplocarpus foetidus		--	8	(0.46)		--	50	(2.80)	17	(0.98)
Thalictrum dasycarpum	6	(0.09)		--		--		--	2	(0.02)
Typha latifolia		--	23	(0.69)		--	5	(0.08)	6	(0.17)
Ferns										
Dryopteris cristata		--		--	8	(0.04)		--	2	(0.01)
Equisetum arvense	12	(0.06)		--	31	(0.15)		--	10	(0.05)
Equisetum fluviatile		--	8	(0.04)		--		--	2	(0.01)
Onoclea sensibilis	59	(4.85)	31	(1.27)	23	(0.38)	70	(2.10)	49	(2.32)
Osmunda regalis		--	8	(0.92)		--		--	2	(0.19)
Thelypteris palustris	35	(0.59)	62	(3.04)	38	(1.08)	70	(1.90)	52	(1.61)
Shrubs										
Cornus amomum		--		--	8	(3.69)	20	(3.90)	8	(2.00)
Cornus foemina	6	(1.41)		--	23	(13.08)		--	6	(3.08)
Cornus stolonifera	12	(2.91)	8	(0.92)	23	(7.85)	10	(0.45)	13	(2.74)
Ribes cynosbati	6	(0.03)		--		--		--	2	(0.01)
Ribes hirtellum		--	23	(0.69)		--		--	5	(0.14)
Rubus strigosus		--		--		--	5	(0.15)	2	(0.05)
Salix discolor		--		--	8	(3.69)		--	2	(0.76)
Salix petiolaris		--		--	8	(0.12)		--	2	(0.02)
Spiraea alba		--		--	8	(0.46)		--	2	(0.10)
Toxicodendron vernix		--		--		--	5	(0.60)	2	(0.19)
Viburnum lentago	6	(0.18)		--		--		--	2	(0.05)
Woody Vines										
Parthenocissus quinquefolia	35	(0.50)		--		--	10	(0.18)	13	(0.19)
Vitis riparia	6	(0.09)		--		--		--	2	(0.02)

Appendix 2.5 Huron Meadow Vegetation Summary, Continued.

	Transect 1		Transect 2		Transect 3		Transect 4		Total	
	length = 80 m		length = 60 m		length = 60 m		length = 95 m		length = 295 m	
	(n = 17)		(n = 13)		(n = 13)		(n = 20)		(n = 63)	
Trees										
Fraxinus pennsylvanica	6	(0.09)	--			--		--	2	(0.02)
Ulmus americana		--	--		8	(0.92)		--	2	(0.19)
Non-Plant Cvoerage										
# of Cx hummocks	100	(4.06)	--		100	(3.38)	75	(2.00)	71	(2.43)
Hummock max height (cm)	40		--		33		34			

Appendix 2.6 Irwin's Road Vegetation Summary

Appendix 2.6 Irwin's Road Vegetation Summary

	Transect 1 length = 95 m (n = 20)
Graminoids	
Bromus ciliatus	5 (0.03)
Calamagrostis canadensis	40 (0.20)
Carex bebbii	20 (0.10)
Carex hystericina	10 (0.10)
Carex lacustris	15 (0.38)
Carex leptalea	30 (0.60)
Carex stricta	95 (18.30)
Carex vulpinoidea	10 (0.05)
Juncus dudleyi	5 (0.03)
Phalaris arundinacea	100 (1.88)
Forbs	
Aster puniceus	20 (0.20)
Campanula aparinoides	55 (0.28)
Eupatorium maculatum	15 (0.18)
Eupatorium perfoliatum	45 (0.70)
Galium asprellum	15 (0.13)
Galium tinctorium	10 (0.05)
Lycopus americanus	35 (0.75)
Lycopus uniflorus	90 (1.65)
Lythrum salicaria	5 (0.03)
Mentha arvensis	5 (0.03)
Pycnanthemum virginianum	100 (3.05)
Rubus pubescens	35 (0.58)
Scutellaria galericulata	10 (0.05)
Senecio aureus	5 (0.03)
Solidago altissima/canadensis	100 (4.13)
Solidago gigantea	5 (0.08)
Sparganium eurycarpum	5 (0.15)
Symplocarpus foetidus	20 (0.53)
Thalictrum dasycarpum	10 (0.10)
Viola cucullata	45 (0.28)
Ferns	
Onoclea sensibilis	15 (0.30)
Thelypteris palustris	80 (2.23)
Shrubs	
Cornus amomum	5 (0.15)
Cornus stolonifera	15 (0.30)
Potentilla fruticosa	10 (0.38)
Sambucus canadensis	5 (0.15)

Appendix 2.6 Irwin's Road Vegetation Summary, Continued.

	Transect 1	
	length = 95 m	
	(n = 20)	
Trees		
Ulmus americana	10	(0.10)
Non-Plant Coverage		
Moss	15	(0.90)
# of Cx hummocks	95	(3.30)
Hummock max height (cm)	95	(27.68)

Appendix 2.7 Leeke Road Vegetation Summary

Appendix 2.7 Leeke Road Vegetation Summary								
	Transect 1		**Transect 2**		**Transect 3**		**Total**	
	length = 90 m		length = 90 m		length = 80 m		length = 260 m	
Species	(n = 19)		(n = 19)		(n = 17)		(n = 55)	
Graminoids								
Calamagrostis canadensis	74	(7.58)	26	(0.45)	59	(5.15)	53	(4.36)
Carex lacustris	47	(11.84)	89	(4.53)	71	(7.50)	69	(7.97)
Carex lasiocarpa	58	(1.79)	37	(3.89)	6	(0.09)	35	(1.99)
Carex sartwellii		--	5	(0.16)		--	2	(0.05)
Carex stricta		--	42	(0.97)	41	(2.53)	27	(1.12)
Dulichium arundinacium	5	(0.08)		--		--	2	(0.03)
Eleocharis erythropoda	26	(0.79)		--		--	9	(0.27)
Scirpus validus	21	(0.21)		--		--	7	(0.07)
Forbs								
Aster borealis		--		--	6	(0.03)	2	(0.01)
Aster laevis		--		--	6	(0.03)	2	(0.01)
Aster lanceolatus	5	(0.08)		--		--	2	(0.03)
Bidens coronatus	11	(0.05)		--		--	4	(0.02)
Campanula aparinoides	47	(0.24)	21	(0.11)	12	(0.06)	27	(0.14)
Cicuta bulbifera	16	(0.08)	5	(0.03)	12	(0.12)	11	(0.07)
Eupatorium maculatum		--		--	6	(0.03)	2	(0.01)
Eupatorium perfoliatum	5	(0.03)		--		--	2	(0.01)
Galium tinctorium	32	(0.16)	5	(0.03)	29	(0.15)	22	(0.11)
Impatiens capensis	58	(0.55)	21	(0.11)	65	(0.38)	47	(0.35)
Iris virginica	5	(0.08)		--		--	2	(0.03)
Lysimachia thyrsiflora	74	(0.89)	53	(0.45)	47	(0.74)	58	(0.69)
Lythrum salicaria		--	68	(15.92)	12	(0.44)	27	(5.64)
Mentha arvensis	21	(0.34)	5	(0.03)	6	(0.09)	11	(0.15)
Pilea pumila		--	5	(0.03)		--	2	(0.01)
Polygonum amphibium	47	(0.76)	53	(0.58)	35	(0.41)	45	(0.59)
Polygonum hydropiper	5	(0.08)		--		--	2	(0.03)
Polygonum hydropiperoides	11	(0.24)		--	6	(0.03)	5	(0.09)
Rumex orbiculata	37	(2.13)	16	(0.39)	29	(1.06)	27	(1.20)
Sagittaria latifolia	95	(7.11)	84	(2.68)	100	(5.85)	93	(5.19)
Scutellaria galericulata	74	(1.08)	16	(0.08)	12	(0.18)	35	(0.45)
Scutellaria lateriflora		--		--	6	(0.03)	2	(0.01)
Solanum dulcamara	11	(1.89)	11	(0.39)		--	7	(0.79)
Typha angustifolia		--	21	(0.39)	12	(0.12)	11	(0.17)
Typha latifolia	100	(5.84)	74	(2.29)	94	(4.76)	89	(4.28)
Ferns								
Onoclea sensibilis	5	(0.63)	5	(0.08)	6	(0.18)	5	(0.30)
Thelypteris palustris	63	(2.76)	53	(1.58)	47	(1.44)	55	(1.95)

Appendix 2.7 Leeke Road Vegetation Summary, Continued.

Species	Transect 1 length = 90 m (n = 19)		Transect 2 length = 90 m (n = 19)		Transect 3 length = 80 m (n = 17)		Total length = 260 m (n = 55)	
Shrubs								
Spiraea alba	11	(3.16)	5	(0.63)		--	5	(1.31)
Non-Plant Coverage								
Water coverage	37	(7.58)	53	(23.13)	53	(15.35)	47	(15.35)
Water depth (cm)	4		8		6		6	

Appendix 2.8 Livingston Road Vegetation Summary

Species	Transect 1 length = 45 m (n = 16)		Transect 2 length = 95 m (n = 20)		Total length = 140 m (n = 36)	
Graminoids						
Calamagrostis canadensis	6	(0.03)	15	(0.08)	11	(0.06)
Carex comosa		--	25	(0.30)	14	(0.17)
Carex lacustris	100	(7.50)	20	(0.40)	56	(3.56)
Carex lasiocarpa		--	20	(0.25)	11	(0.14)
Carex stricta	44	(6.59)	55	(0.75)	50	(3.35)
Eleocharis elliptica		--	80	(5.88)	44	(3.26)
Eleocharis erythropoda	38	(0.50)		--	17	(0.22)
Leersia oryzoides		--	30	(0.35)	17	(0.19)
Scirpus validus		--	15	(0.08)	8	(0.04)
Forbs						
Aster borealis	13	(0.06)	10	(0.10)	11	(0.08)
Aster puniceus	88	(7.34)	75	(1.23)	81	(3.94)
Bidens coronata	31	(0.16)	75	(0.58)	56	(0.39)
Caltha palustris		--	10	(0.10)	6	(0.06)
Campanula aparinoides	50	(0.25)	65	(0.38)	58	(0.32)
Cicuta bulbifera	6	(0.03)	50	(0.25)	31	(0.15)
Epilobium leptophyllum		--	5	(0.03)	3	(0.01)
Eupatorium maculatum	31	(0.84)	5	(0.03)	17	(0.39)
Eupatorium perfoliatum	19	(0.16)	35	(0.28)	28	(0.22)
Galium tinctorium	63	(0.31)	55	(0.28)	58	(0.29)
Impatiens capensis	88	(1.88)	70	(1.45)	78	(1.64)
Iris virginica		--	5	(0.03)	3	(0.01)
Lycopus uniflorus	63	(0.44)	85	(0.83)	75	(0.65)
Lysimachia thyrsiflora	44	(0.53)	85	(0.93)	67	(0.75)
Lythrum salicaria	69	(9.56)	100	(41.10)	86	(27.08)
Mentha arvensis	38	(0.25)	15	(0.08)	25	(0.15)
Pilea pumila	75	(0.75)	75	(0.63)	75	(0.68)
Polygonum amphibium	6	(0.03)		--	3	(0.01)
Polygonum sagitatum	19	(0.09)	10	(0.05)	14	(0.07)
Rorippa palustris		--	5	(0.03)	3	(0.01)
Rumex orbiculata	13	(0.19)	45	(0.78)	31	(0.51)
Sagittaria latifolia		--	85	(0.85)	47	(0.47)
Scutellaria galericulata	13	(0.06)	5	(0.03)	8	(0.04)
Solidago altissima/canadensis	38	(0.88)		--	17	(0.39)
Solidago gigantea		--	5	(0.08)	3	(0.04)
Solidago patula	6	(0.09)		--	3	(0.04)
Typha latifolia	63	(1.63)	90	(1.63)	78	(1.63)
Viola sp.	31	(0.41)		--	14	(0.18)
Ferns						
Equisetum fluviatile		--	5	(0.03)	3	(0.01)
Onoclea sensibilis	25	(9.16)	5	(0.08)	14	(4.11)

Appendix 2.8 Livingston Road Vegetation Summary, Continued.

Species	Transect 1		Transect 2		Total	
	length = 45 m		length = 95 m		length = 140 m	
	(n = 16)		(n = 20)		(n = 36)	
Shrubs						
Cornus stolonifera	6	(0.19)		--	3	(0.08)
Ribes americanum	25	(0.50)		--	11	(0.22)
Ribes hirtellum	25	(0.34)		--	11	(0.15)
Salix discolor		--	10	(1.20)	6	(0.67)
Spiraea alba	6	(0.38)		--	3	(0.17)
Non-Plant Coverage						
Moss	19	(1.88)	5	(0.60)	11	(1.17)
# of Cx hummocks	0.4			--	0.2	
Hummock max height (cm)	17			--	17	

Appendix 2.9 M-59 Vegetation Summary

Appendix 2.9 M-59 Vegetation Summary						
	Transect 1		**Transect 2**		**Total**	
	length = 95 m		length = 95 m		length = 190 m	
Species	(n = 20)		(n = 20)		(n = 40)	
Graminoids						
Calamagrostis canadensis	95	(14.58)	100	(20.48)	98	(17.53)
Carex lasiocarpa	85	(13.28)	100	(16.98)	93	(15.13)
Carex stricta	55	(2.05)	75	(1.90)	65	(1.98)
Cladium mariscoides	10	(0.05)		--	5	(0.03)
Dulichium arundinacium	5	(0.03)		--	3	(0.01)
Eleocharis elliptica	5	(0.08)		--	3	(0.04)
Scirpus acutus	20	(0.23)	5	(0.03)	13	(0.13)
Forbs						
Asclepias incarnata		--	5	(0.30)	3	(0.15)
Bidens coronatus		--	35	(0.18)	18	(0.09)
Bidens frondusus	15	(0.08)		--	8	(0.04)
Campanula aparinoides	35	(0.18)	65	(0.33)	50	(0.25)
Cicuta bulbifera	15	(0.08)	10	(0.05)	13	(0.06)
Cirsium arvense	5	(0.15)		--	3	(0.08)
Erechtites hieracifolia	20	(0.15)		--	10	(0.08)
Eupatorium maculatum	20	(0.33)	10	(0.15)	15	(0.24)
Eupatorium perfoliatum		--	10	(0.33)	5	(0.16)
Fragaria virginiana	45	(0.63)	15	(0.08)	30	(0.35)
Galium tinctorium	15	(0.08)	20	(0.10)	18	(0.09)
Hypericum sp.	40	(0.25)		--	20	(0.13)
Iris virginica		--	5	(0.08)	3	(0.04)
Lycopus americanus		--	5	(0.30)	3	(0.15)
Lycopus uniflorus	80	(1.73)	90	(2.38)	85	(2.05)
Lysimachia thyrsiflora	25	(0.18)	10	(0.05)	18	(0.11)
Mentha arvensis		--	5	(0.30)	3	(0.15)
Nuphar advena	10	(0.23)	10	(0.90)	10	(0.56)
Polygonum amphibium	70	(0.88)	85	(1.20)	78	(1.04)
Potentilla palustris	50	(1.18)	20	(0.33)	35	(0.75)
Sagittaria latifolia		--	35	(0.28)	18	(0.14)
Scutellaria galericulata	40	(0.30)	25	(0.13)	33	(0.21)
Solanum dulcamara	10	(0.10)		--	5	(0.05)
Solidago altissima/canadensis	10	(0.18)	5	(0.08)	8	(0.13)
Triadenum fraseri	35	(0.30)		--	18	(0.15)
Typha latifolia	10	(0.30)		--	5	(0.15)
Ferns						
Dryopteris cristata		--	25	(0.33)	13	(0.16)
Thelypteris palustris	50	(8.40)	15	(0.75)	33	(4.58)

Appendix 2.9 M-59 Vegetation Summary, Continued

Appendix 2.9 M-59 Vegetation Summary, Continued						
	Transect 1		**Transect 2**		**Total**	
	length = 95 m		length = 95 m		length = 190 m	
Species	(n = 20)		(n = 20)		(n = 40)	
Shrubs						
Cephalanthus occidentalis	80	(3.58)	35	(0.78)	58	(2.18)
Rosa palustris	10	(0.33)		--	5	(0.16)
Salix exigua	10	(0.68)	5	(0.08)	8	(0.38)
Salix serissima	5	(0.08)	20	(0.25)	13	(0.16)
Vaccinium oxycoccos		--	15	(0.23)	8	(0.11)
Non-Plant Coverage						
# of Cx hummocks	75	(3.40)	100	(3.85)	88	(3.63)
Hummock max height (cm)	75	(36.13)	100	(21.30)	88	(28.72)

Appendix 2.10 Maute Road Vegetation Summary, Continued

Appendix 2.10 Maute Road Vegetation Summary, Continued								
	Transect 1		Transect 2		Transect 3		Total	
	length = 90 m		length = 60 m		length = 90 m		length = 240 m	
Species	(n = 19)		(n = 13)		(n = 19)		(n = 51)	
Woody Vines								
Parthenocissus quinquefolia		--	8	(0.12)		--	2	(0.03)
Non-Plant Coverage								
Water coverage	26	(3.63)	8	(1.85)	100	(71.26)	49	(28.37)
Water depth (cm)	3		3		32		14	
Moss		--	15	(0.69)	16	(1.42)	10	(0.71)
Algae	5	(1.26)		--		--	2	(0.47)
# of Cx hummocks	37	(0.74)	54	(1.46)	47	(1.47)	45	(1.20)
Hummock max height (cm)	37	(29.43)	54	(30.43)	47	(45.56)	45	(35.69)

Appendix 2.11 Orr Road Vegetation Summary

Appendix 2.11 Orr Road Vegetation Summary			
		Transect 1	
		length = 90 m	
Species		(n = 20)	
Graminoids			
	Calamagrostis canadensis	35	(2.90)
	Carex lasiocarpa	100	(21.68)
	Cladium mariscoides	35	(0.33)
	Dulichium arundinacium	5	(0.03)
	Eleocharis erythropoda	55	(0.83)
	Eleocharis smallii	25	(0.98)
	Rhynchospora capillacea	15	(4.15)
	Juncus dudleyi	20	(0.15)
	Juncus nodosus	15	(0.18)
Forbs			
	Drossera intermedia	95	(2.83)
	Epilobium perennis	20	(0.10)
	Hypericum sp.	25	(0.30)
	Lycopus uniflorus	90	(3.08)
	Triadenum fraseri	100	(1.45)
Shrubs			
	Chamaedaphne calyculata	10	(1.23)
Non-Plant Coverage			
	Water depth (cm)	60	(11.05)
	Moss	0	#DIV/0!
	Hummock max height (cm)		

Appendix 2.12 Rank Road Vegetation Summary

Appendix 2.12 Rank Road Vegetation Summary						
	Transect 1		**Transect 2**		**Total**	
	length = 95 m		length = 95 m		length = 190 m	
Species	(n = 20)		(n = 20)		(n = 40)	
Graminoids						
Calamagrostis canadensis	100	(35.23)	10	(0.05)	55	(17.64)
Carex comosa	35	(0.43)	25	(0.50)	30	(0.46)
Carex lacustris	10	(0.75)		--	5	(0.38)
Carex lasiocarpa	75	(4.03)	5	(0.03)	40	(2.03)
Carex stricta	5	(0.15)		--	2.5	(0.08)
Carex vulpinoidea	20	(0.25)		--	10	(0.13)
Dulichium arundinacium	5	(0.03)		--	2.5	(0.01)
Eleocharis elliptica	10	(0.10)	15	(0.18)	13	(0.14)
Eleocharis erythropoda	60	(1.25)	20	(0.20)	40	(0.73)
Juncus effusus	40	(0.63)	100	(39.20)	70	(19.91)
Leersia oryzoides		--	90	(2.58)	45	(1.29)
Phalaris arundinacea		--	10	(0.90)	5	(0.45)
Scirpus atrovirens		--	5	(0.15)	2.5	(0.08)
Scirpus validus	30	(0.15)		--	15	(0.08)
Forbs						
Bidens coronatus		--	5	(0.03)	2.5	(0.01)
Cicuta bulbifera	10	(0.05)		--	5	(0.03)
Galium tinctorium	55	(0.28)	75	(0.43)	65	(0.35)
Lycopus americanus	5	(0.08)	5	(0.03)	5	(0.05)
Lycopus uniflorus	20	(0.10)		--	10	(0.05)
Lysimachia thyrsiflora	5	(0.03)	15	(0.08)	10	(0.05)
Mentha arvensis		--	10	(0.05)	5	(0.03)
Nymphaea odorata	80	(8.03)	75	(2.43)	78	(5.23)
Polygonum amphibium	95	(8.18)	15	(0.08)	55	(4.13)
Polygonum hydropiperoides	5	(1.20)	75	(2.53)	40	(1.86)
Potamogeton illinoensis		--	30	(0.25)	15	(0.13)
Sagittaria latifolia	10	(0.05)	5	(0.03)	7.5	(0.04)
Scutellaria latifolia	10	(0.05)		--	5	(0.03)
Typha latifolia		--	10	(0.33)	5	(0.16)
Woody Vines						
Vitis riparia		--	5	(0.03)	2.5	(0.01)
Non-Plant Coverage						
# of Cx hummocks	10	(0.20)		--	5	(0.10)
Hummock max height (cm)	10	(23.50)		#DIV/0!	5	#DIV/0!

Appendix 2.13 Teeple Lake Vegetation Summary

Appendix 2.13 Teeple Lake Vegetation Summary			
	Transect 1	**Transect 2**	**Total**
	length = 120 m	Length = 75 m	Length = 195 m
Species	(n = 25)	(n = 16)	(n = 41)
Graminoids			
Calamagrostis canadensis	20 (0.36)	63 (1.25)	37 (0.71)
Carex comosa	--	6 (0.03)	2 (0.01)
Carex lacustris	72 (3.96)	6 (0.03)	46 (2.43)
Carex sartwellii	--	6 (0.03)	2 (0.01)
Carex stricta	100 (32.80)	94 (27.31)	98 (30.66)
Leersia oryzoides	--	6 (0.03)	2 (0.01)
Muhlenbergia glomerata	4 (0.02)	--	2 (0.01)
Forbs			
Apios americana	--	56 (0.28)	22 (0.11)
Asclepias incarnata	--	6 (0.03)	2 (0.01)
Aster borealis	--	6 (0.03)	2 (0.01)
Aster lateriflorus	--	6 (0.03)	2 (0.01)
Aster puniceus	88 (2.82)	56 (0.66)	76 (1.98)
Bidens coronatus	16 (0.08)	56 (0.41)	32 (0.21)
Caltha palustris	--	6 (0.03)	2 (0.01)
Campanula aparinoides	80 (0.56)	75 (0.44)	78 (0.51)
Chelone glabra	--	6 (0.03)	2 (0.01)
Cicuta bulbifera	28 (0.14)	56 (0.28)	39 (0.20)
Epilobium leptophyllum	4 (0.02)	--	2 (0.01)
Eupatorium maculatum	88 (2.60)	75 (3.84)	83 (3.09)
Eupatorium perfoliatum	--	13 (0.13)	5 (0.05)
Galium tinctorium	20 (0.14)	56 (0.28)	34 (0.20)
Impatiens capensis	100 (3.02)	94 (2.25)	98 (2.72)
Iris virginica	4 (0.06)	--	2 (0.04)
Lemna minor	--	19 (0.09)	7 (0.04)
Lycopus uniflorus	36 (0.30)	81 (0.78)	54 (0.49)
Lythrum salicaria	--	100 (35.41)	39 (13.82)
Mentha arvensis	40 (0.28)	13 (0.06)	29 (0.20)
Polygonum amphibium	28 (0.42)	38 (0.31)	32 (0.38)
Potentilla palustris	--	6 (0.09)	2 (0.04)
Rumex orbiculata	4 (0.02)	38 (0.47)	17 (0.20)
Scutellaria galericulata	8 (0.04)	25 (0.19)	15 (0.10)
Sium suave	--	6 (0.09)	2 (0.04)
Solanum dulcamara	4 (0.12)	--	2 (0.07)
Solidago altissima/canadensis	40 (1.06)	13 (0.06)	29 (0.67)
Solidago gigantea	4 (0.02)	6 (0.03)	5 (0.02)
Typha latifolia	--	44 (0.53)	17 (0.21)
Urtica dioica	4 (0.02)	--	2 (0.01)
Viola sp.	--	6 (0.03)	2 (0.01)
Viola cucullata	--	6 (0.09)	2 (0.04)

Appendix 2.13 Teeple Lake Vegetation Summary, Continued

Appendix 2.13 Teeple Lake Vegetation Summary, Continued						
	Transect 1		**Transect 2**		**Total**	
	length = 120 m		Length = 75 m		Length = 195 m	
Species	(n = 25)		(n = 16)		(n = 41)	
Ferns						
Equisetum fluviatile		--	19	(0.16)	7	(0.06)
Onoclea sensibilis	28	(2.52)	25	(0.69)	27	(1.80)
Thelypteris palustris	76	(5.18)	88	(3.09)	80	(4.37)

Teeple Lake						
	Transect 1		**Transect 2**		**Total**	
	length = 120 m		Length = 75 m		Length = 195 m	
Species	(n = 25)		(n = 16)		(n = 41)	
Shrubs						
Cornus amomum	12	(5.12)	13	(1.69)	12	(3.78)
Cornus stolonifera	12	(0.30)	25	(0.78)	17	(0.49)
Decodon vertricillatus		--	13	(0.47)	5	(0.18)
Ilex verticillata		--	6	(0.09)	2	(0.04)
Rhamnus frangula		--	6	(0.19)	2	(0.07)
Ribes americanum	8	(1.44)		--	5	(0.88)
Ribes hirtellum	8	(0.18)		--	5	(0.11)
Rosa palustris	4	(0.06)		--	2	(0.04)
Salix candida		--	6	(0.38)	2	(0.15)
Salix discolor	4	(0.02)		--	2	(0.01)
Salix exigua		--	6	(0.09)	2	(0.04)
Salix petiolaris		--	6	(0.09)	2	(0.04)
Spiraea alba	8	(0.04)	44	(1.84)	22	(0.74)
Toxicodendron vernix		--	6	(0.19)	2	(0.07)
Trees						
Acer saccharinum	4	(0.02)		--	2	(0.01)
Non-Plant Coverage						
Water coverage		--	25	(9.75)	10	(3.80)
Water depth (cm)			11		11	
Moss	32	(0.72)	19	(2.25)	27	(1.32)
# of Cx hummocks	4		3		3	
Hummock max height (cm)	28		41		33	

Appendix 2.14 Thread Creek Vegetation Summary

Appendix 2.14 Thread Creek Vegetation Summary						
	Transect 1		**Transec 2**		**Total**	
	length = 95 m		length = 95 m		length = 190 m	
Species	(n = 20)		(n = 20)		(n = 40)	
Graminoids						
Calamagrostis canadensis	30	(1.18)		--	15	(0.59)
Carex bebbii		--	5	(0.03)	3	(0.01)
Carex hystericina	30	(0.53)		--	15	(0.26)
Carex lacustris	60	(9.05)	5	(0.03)	33	(4.54)
Carex sp.		--	10	(0.23)	5	(0.11)
Carex stipata	15	(0.18)		--	8	(0.09)
Carex vulpinoidea	5	(0.03)		--	3	(0.01)
Eleocharis erythropoda		--	5	(0.08)	3	(0.04)
Juncus tenuis	5	(0.03)		--	3	(0.01)
Leersia oryzoides	10	(0.18)	35	(4.10)	23	(2.14)
Phalaris arundinacea	5	(0.15)		--	3	(0.08)
Forbs						
Acorus calamus	5	(2.40)		--	3	(1.20)
Apios americana	35	(0.63)		--	18	(0.31)
Aster puniceus	70	(1.50)	10	(0.10)	40	(0.80)
Bidens connatus		--	35	(1.05)	18	(0.53)
Bidens coronatus		--	5	(0.03)	3	(0.01)
Bidens frondusus		--	20	(0.48)	10	(0.24)
Calla palustris		--	5	(0.03)	3	(0.01)
Caltha palustris	20	(0.48)		--	10	(0.24)
Campanula aparinoides	5	(0.03)		--	3	(0.01)
Chelone glabra	5	(0.03)		--	3	(0.01)
Cicuta bulbifera		--	30	(0.20)	15	(0.10)
Cicuta maculata	5	(0.08)		--	3	(0.04)
Cuscuta gronovii	30	(0.15)	5	(0.03)	18	(0.09)
Epilobium coloratum	5	(0.08)	5	(0.03)	5	(0.05)
Eupatorium maculatum	60	(1.80)		--	30	(0.90)
Eupatorium perfoliatum	35	(1.35)	10	(0.68)	23	(1.01)
Fragaria virginiana	5	(0.03)		--	3	(0.01)
Galium asprellum	65	(1.08)		--	33	(0.54)
Galium tinctorium		--	5	(0.03)	3	(0.01)
Impatiens capensis	90	(8.03)	90	(11.10)	90	(9.56)
Lycopus uniflorus	15	(0.13)	5	(0.08)	10	(0.10)
Lysimachia ciliata	5	(0.03)		--	3	(0.01)
Lysimachia thyrsiflora	5	(0.03)		--	3	(0.01)
Mentha arvensis	20	(0.15)		--	10	(0.08)
Pilea pumila	45	(1.28)	90	(5.20)	68	(3.24)
Polygonum hydropiperoides	5	(0.03)	40	(0.80)	23	(0.41)
Rorippa palustris		--	5	(0.08)	3	(0.04)
Rubus pubescens	15	(0.45)		--	8	(0.23)
Rumex orbiculata		--	5	(0.15)	3	(0.08)
Saxifraga pensylvanica	5	(0.08)		--	3	(0.04)

Appendix 2.14 Thread Creek Vegetation Summary, Continued

Appendix 2.14 Thread Creek Vegetation Summary, Continued						
	Transect 1		**Transec 2**		**Total**	
	length = 95 m		length = 95 m		length = 190 m	
Species	(n = 20)		(n = 20)		(n = 40)	
Forbs (Continued)						
Scutellaria galericulata	30	(0.15)	10	(0.10)	20	(0.13)
Solanum dulcamara	5	(0.03)	5	(0.08)	5	(0.05)
Solidago gigantea	5	(0.03)		--	3	(0.01)
Solidago patula	50	(2.28)		--	25	(1.14)
Solidago rugosa	10	(0.18)		--	5	(0.09)
Symplocarpus foetidus	75	(4.95)	30	(1.58)	53	(3.26)
Typha angustifolia	10	(0.68)	100	(49.28)	55	(24.98)
Typha latifolia	85	(6.08)		--	43	(3.04)
Viola sp.		--	5	(0.03)	3	(0.01)
Ferns						
Onoclea sensibilis	20	(0.33)	5	(0.30)	13	(0.31)
Thelypteris palustris	35	(1.28)	35	(0.68)	35	(0.98)
Woody Vines						
Parthenocissus quinquefolia	20	(0.38)	5	(0.30)	13	(0.34)
Toxicodendron radicans		--	5	(0.15)	3	(0.08)
Shrubs						
Alnus rugosa	5	(0.60)		--	3	(0.30)
Carpinus caroliniana	5	(0.15)		--	3	(0.08)
Cornus amomum	25	(5.35)	15	(0.98)	20	(3.16)
Cornus foemina	20	(2.03)		--	10	(1.01)
Cornus stolonifera	40	(2.55)	10	(1.50)	25	(2.03)
Corylus americana	10	(0.68)		--	5	(0.34)
Elaeagnus umbellata	10	(3.73)		--	5	(1.86)
Rhamnus frangula	5	(0.08)	5	(0.15)	5	(0.11)
Ribes americanum	25	(1.28)		--	13	(0.64)
Ribes cynosbati	5	(0.08)		--	3	(0.04)
Ribes hirtellum		--	5	(0.30)	3	(0.15)
Rubus strigosus		--	5	(2.40)	3	(1.20)
Salix discolor	10	(2.43)		--	5	(1.21)
Sambucus canadensis	5	(0.08)		--	3	(0.04)
Toxicodendron vernix	10	(2.40)		--	5	(1.20)
Viburnum lentago	10	(0.75)		--	5	(0.38)
Trees						
Acer saccharinum	5	(0.08)		--	3	(0.04)
Fraxinus nigra	5	(1.20)		--	3	(0.60)
Non-Plant Coverage						
Water coverage	5	(0.60)		--	3	(0.30)

Appendix 2.15 Waterbury Vegetation Summary

Appendix 2.15 Waterbury Vegetation Summary						
	Transect 1		**Transect 2**		**Total**	
	length = 50 m		length = 45 m		length = 95 m	
Species	(n = 11)		(n = 10)		(n = 21)	
Graminoids						
Calamagrostis canadensis		--	30	(0.15)	14	(0.07)
Carex lacustris	91	(8.77)	100	(11.10)	95	(9.88)
Carex sartwellii		--	10	(0.05)	5	(0.02)
Carex stricta	9	(6.73)	30	(1.55)	19	(4.26)
Forbs						
Apocynum androesimifolia		--	30	(0.70)	14	(0.33)
Asclepias incarnata	9	(0.05)		--	5	(0.02)
Aster puniceus	55	(1.68)	90	(1.50)	71	(1.60)
Bidens coronatus	36	(0.18)		--	19	(0.10)
Caltha palustris	9	(0.14)	30	(2.10)	19	(1.07)
Campanula aparinoides		--	20	(0.10)	10	(0.05)
Chelone glabra		--	10	(0.15)	5	(0.07)
Cicuta maculata		--	10	(0.15)	5	(0.07)
Cirsium arvense		--	20	(0.20)	10	(0.10)
Eupatorium maculatum	45	(0.59)	70	(2.40)	57	(1.45)
Eupatorium perfoliatum	18	(0.27)		--	10	(0.14)
Galium tinctorium	9	(0.05)	10	(0.05)	10	(0.05)
Galium triflorum		--	10	(0.05)	5	(0.02)
Hydrocotyle americana	27	(0.23)	50	(0.35)	38	(0.29)
Hypericum sp.		--	20	(0.10)	10	(0.05)
Impatiens capensis		--	50	(0.25)	24	(0.12)
Lycopus americanus		--	10	(0.05)	5	(0.02)
Lycopus uniflorus	27	(0.14)	70	(0.35)	48	(0.24)
Lysimachia thyrsiflora	9	(0.14)		--	5	(0.07)
Lythrum salicaria	55	(4.09)	70	(16.80)	62	(10.14)
Polygonum sagitatum		--	70	(0.35)	33	(0.17)
Rubus pubescens		--	20	(0.20)	10	(0.10)
Rumex orbiculata	27	(0.32)		--	14	(0.17)
Saxifraga pensylvanica		--	20	(0.30)	10	(0.14)
Scutellaria galericulata		--	10	(0.15)	5	(0.07)
Solidago altissima/canadensis		--	20	(0.35)	10	(0.17)
Solidago patula		--	20	(0.45)	10	(0.21)
Typha latifolia	64	(2.59)	20	(0.10)	43	(1.40)
Viola sp.		--	10	(0.05)	5	(0.02)

Appendix 2.15 Waterbury Vegetation Summary, Continued

Appendix 2.15 Waterbury Vegetation Summary, Continued						
	Transect 1		**Transect 2**		**Total**	
	length = 50 m		length = 45 m		length = 95 m	
Species	(n = 11)		(n = 10)		(n = 21)	
Ferns						
Equisetum arvense		--	20	(0.20)	10	(0.10)
Onoclea sensibilis	91	(22.91)	100	(19.20)	95	(21.14)
Thelypteris palustris	82	(3.55)	80	(3.60)	81	(3.57)
Shrubs						
Cornus foemina	18	(0.41)		--	10	(0.21)
Cornus stolonifera	45	(7.91)	40	(2.10)	43	(5.14)
Potentilla fruticosa	9	(0.55)	10	(0.05)	10	(0.31)
Ribes cynosbati		--	10	(0.05)	5	(0.02)
Ribes hirtellum		--	20	(0.45)	10	(0.21)
Sambucus canadensis		--	10	(0.30)	5	(0.14)
Spiraea alba	9	(0.55)	10	(0.30)	10	(0.43)
Toxicodendron vernix		--	10	(1.20)	5	(0.57)
Non-Plant Coverage						
Moss	9	(0.27)	70	(6.00)	38	(3.00)
# of Cx hummocks	9	(1.00)	10	(0.20)	10	(0.62)
Hummock max height (cm)	9	(2.55)	10	(15.00)	10	(8.48)

Appendix 2.16 Waterford Kettering Vegetation Summary

Appendix 2.16 Waterford Kettering Veg. Summary		
		Transect 1
		length = 95 m
		(n = 20)
Graminoids		
Carex hystericina	10	(0.10)
Forbs		
Bidens frondusus	25	(0.18)
Boehmeria cylindrica	15	(0.08)
Campanula aparinoides	5	(0.03)
Cicuta bulbifera	60	(0.58)
Galium tinctorium	40	(0.20)
Lycopus uniflorus	50	(0.63)
Lysimachia thyrsiflora	80	(1.73)
Lythrum salicaria	70	(5.40)
Polygonum amphibium	10	(0.10)
Polygonum sagitatum	10	(0.05)
Scutellaria galericulata	10	(0.10)
Triadenum fraseri	20	(0.15)
Typha angustifolia	65	(8.03)
Typha latifolia	65	(3.83)
Ferns		
Onoclea sensibilis	20	(0.48)
Osmunda regalis	5	(0.30)
Thelypteris palustris	70	(5.28)
Shrubs		
Cephalanthus occidentalis	5	(0.60)
Decodon vertricillatus	95	(8.63)
Salix discolor	5	(0.15)
Salix petiolaris	5	(1.20)
Spiraea alba	45	(8.18)
Trees		
Acer saccharinum	10	(0.05)

Appendix 2.17 Waterloo-Munith Vegetation Summary

Appendix 2.17 Waterloo-Munith Vegetation Summary						
	Transect 1		**Transect 2**		**Total**	
	length = 120 m		length = 120 m		length = 240 m	
Species	(n = 25)		(n = 25)		(n = 50)	
Graminoids						
Calamagrostis canadensis	84	(33.50)	4	(0.12)	44	(16.81)
Carex lacustris	20	(0.26)	100	(36.22)	60	(18.24)
Carex lasiocarpa		--	16	(0.26)	8	(0.13)
Carex sartwellii		--	8	(0.04)	4	(0.02)
Carex stricta	8	(0.04)	40	(0.32)	24	(0.18)
Eleocharis smallii		--	4	(0.02)	2	(0.01)
Phalaris arundinacea	44	(18.02)		--	22	(9.01)
Scirpus acutus	16	(0.08)		--	8	(0.04)
Scirpus atrovirens		--	4	(0.96)	2	(0.48)
Scirpus validus		--	4	(0.02)	2	(0.01)
Forbs						
Aster borealis		--	8	(0.04)	4	(0.02)
Aster puniceus		--	12	(0.16)	6	(0.08)
Bidens coronatus		--	8	(0.08)	4	(0.04)
Bidens frondusus	4	(0.02)		--	2	(0.01)
Campanula aparinoides	36	(0.22)	44	(0.22)	40	(0.22)
Cicuta bulbifera	8	(0.04)	12	(0.06)	10	(0.05)
Eupatorium maculatum		--	36	(1.42)	18	(0.71)
Galium tinctorium	8	(0.04)	56	(0.28)	32	(0.16)
Impatiens capensis	28	(0.32)	16	(0.28)	22	(0.30)
Iris virginica		--	4	(0.06)	2	(0.03)
Lycopus americanus		--	4	(0.02)	2	(0.01)
Lycopus uniflorus	4	(0.02)	12	(0.16)	8	(0.09)
Lysimachia thyrsiflora	20	(0.26)	44	(0.30)	32	(0.28)
Mentha arvensis		--	20	(0.30)	10	(0.15)
Nuphar advena	4	(0.12)		--	2	(0.06)
Peltandra virginica	44	(4.74)		--	22	(2.37)
Polygonum amphibium	20	(0.22)	44	(0.38)	32	(0.30)
Polygonum hydropiperoides	4	(0.02)		--	2	(0.01)
Rumex orbiculata	4	(0.02)	12	(0.18)	8	(0.10)
Sagittaria latifolia		--	4	(0.06)	2	(0.03)
Scutellaria galericulata	20	(0.10)	40	(0.28)	30	(0.19)
Scutellaria latifolia		--	4	(0.06)	2	(0.03)
Sium suave		--	4	(0.02)	2	(0.01)
Solanum dulcamara	36	(1.88)	12	(0.54)	24	(1.21)
Solidago altissima/canadensis		--	4	(0.02)	2	(0.01)
Sparganium eurycarpum	12	(0.14)	72	(3.06)	42	(1.60)
Typha latifolia	80	(4.32)	8	(0.08)	44	(2.20)

Appendix 2.17 Waterloo-Munith Vegetation Summary, Continued

Appendix 2.17 Waterloo-Munith Vegetation Summary, Continued

Species	Transect 1 length = 120 m (n = 25)	Transect 2 length = 120 m (n = 25)	Total length = 240 m (n = 50)
Ferns			
Equisetum fluviatile	--	8 (0.04)	4 (0.02)
Onoclea sensibilis	--	4 (0.06)	2 (0.03)
Thelypteris palustris	--	4 (0.48)	2 (0.24)
Shrubs			
Decodon vertricillatus	32 (0.76)	--	16 (0.38)
Non-Plant Coverage			
Moss	--	24 (5.52)	12 (2.76)

Appendix 2.18 Williamsville Vegetation Summary

Appendix 2.18 Williamsville Vegetation Summary						
	Transect 1		**Transect 2**		**Total**	
	length = 95 m		length = 95		length = 190 m	
	(n = 20)		(n = 20)		(n = 40)	
Graminoids						
Calamagrostis canadensis	95	(8.28)	45	(0.85)	70	(4.56)
Carex lacustris		--	30	(0.90)	15	(0.45)
Carex lasiocarpa	85	(10.10)		--	43	(5.05)
Carex stricta	90	(12.80)	85	(43.28)	88	(28.04)
Eleocharis erythropoda	35	(0.23)		--	18	(0.11)
Spartina pectinata	5	(0.03)		--	3	(0.01)
Forbs						
Aster borealis	5	(0.03)	40	(0.43)	23	(0.23)
Aster puniceus	20	(0.38)	75	(2.43)	48	(1.40)
Bidens coronatus	30	(0.15)	5	(0.03)	18	(0.09)
Calystegia sepium		--	5	(0.15)	3	(0.08)
Campanula aparinoides	55	(0.43)	60	(0.65)	58	(0.54)
Cicuta bulbifera	10	(0.05)	10	(0.05)	10	(0.05)
Eupatorium maculatum	10	(0.10)	100	(5.25)	55	(2.68)
Eupatorium perfoliatum	5	(0.15)		--	3	(0.08)
Galium tinctorium	40	(0.25)	50	(0.35)	45	(0.30)
Impatiens capensis		--	100	(9.23)	50	(4.61)
Iris virginica	5	(0.15)		--	3	(0.08)
Lathyrus palustris	5	(0.03)	15	(0.30)	10	(0.16)
Lycopus uniflorus	100	(1.58)	60	(0.60)	80	(1.09)
Lysimachia thyrsiflora	5	(0.03)	5	(0.03)	5	(0.03)
Mentha arvensis		--	55	(1.03)	28	(0.51)
Polygonum amphibium	85	(1.53)	40	(0.48)	63	(1.00)
Pycnanthemum virginianum		--	5	(0.08)	3	(0.04)
Rumex orbiculata		--	10	(0.23)	5	(0.11)
Scutellaria galericulata	40	(0.40)	80	(0.80)	60	(0.60)
Solanum dulcamara		--	5	(0.15)	3	(0.08)
Solidago altissima/canadensis	20	(0.60)		--	10	(0.30)
Taraxacum officionale		--	5	(0.03)	3	(0.01)
Ferns						
Dryopteris cristata		--	5	(0.03)	3	(0.01)
Onoclea sensibilis		--	15	(5.20)	8	(2.60)
Thelypteris palustris	10	(2.70)	5	(0.15)	8	(1.43)

Appendix 2.18 Williamsville Vegetation Summary, Continued

Appendix 2.18 Williamsville Vegetation Summary, Continued	**Transect 1**		**Transect 2**		**Total**	
	length = 95 m		length = 95		length = 190 m	
	(n = 20)		(n = 20)		(n = 40)	
Shrubs						
Ilex verticillata	5	(0.15)		--	3	(0.08)
Spiraea alba	5	(0.15)	20	(4.08)	13	(2.11)
Trees						
Fraxinus pennsylvanica	20	(0.40)	5	(0.08)	13	(0.24)
Non-Plant Coverage						
Water coverage	10	(2.40)		--	5	(1.20)
Water depth (cm)	10	(7.50)		#DIV/0!	5	#DIV/0!
Moss		--	10	(0.30)	5	(0.15)
# of Cx hummocks	70	(4.15)	85	(4.10)	78	(4.13)
Hummock max height (cm)	70	(14.93)	85	(29.47)	78	(22.20)

Appendix 2.19-23 Vegetation Summary for Sites in the Manistee Subdistrict

Appendix 2.19-23 Vegetation Summary

	Stone Road	Forest Hill Road	Nurnberg Road	Nurnberg Bog	Nordhouse Marsh[2]
Transect Length (m)	95	70	30	70	--
Number of Plots	(n = 20)	(n = 15)	(n = 15)	(n = 15)	--
Graminoids					
Calamagrostis canadensis	60 (8.4)	73 (4.2)	--	--	--
Carex aquatilis	--	47 (1.2)	--	--	--
Carex crinita	--	--	--	--	p
Carex lacustris	--	--	7 (0.0)	--	p
Carex lasiocarpa	60 (0.5)	27 (1.3)	--	27 (0.4)	--
Carex pauciflora	--	--	--	20 (0.4)	--
Carex stricta	--	--	--	20 (0.6)	p
Carex vulpinoidea	--	--	--	--	p
Glyceria borealis	p	7 (0.1)	7 (0.1)	--	p
Phalaris arundinacea	--	13 (0.3)	100 (28.1)	--	--
Scirpus atrovirens	--	--	--	--	p
Scirpus cyperinus	--	--	7 (0.1)	13 (0.4)	p
Spartina pectinata	85 (25.9)	93 (6.6)	--	--	
Forbs					
Eupatorium perfoliatum	--	--	--	--	p
Euthamia graminifolia	10 (0.2)	20 (1.1)	--	--	--
Iris virginica	p	13 (0.3)	--	--	--
Lemna minor	--	--	47 (0.3)	--	--
Lycopus uniflorus	--	--	7 (0.1)	--	p
Lysimachia thyrsiflora	50 (1.1)	33 (0.4)	--	--	--
Menyanthes trifoliata	--	--	--	7 (1.6)	--
Pyrola elliptica	--	--	--	7 (0.0)	--
Sium suave	--	--	7 (0.0)	--	--
Solidago canadensis	--	--	--	--	p
Trientalis borealis	--	--	--	27 (0.1)	--
Typha latifolia	--	--	60 (6.1)	--	p
Utricularia vulgaris	5 (0.2)	--	--	--	
Ferns					
Lycopodium annotinum	--	--	--	7 (0.0)	--
Woodwardia virginica	--	--	--	40 (3.7)	--
Shrubs					
Aronia melanocarpa	--	--	--	13 (0.1)	--
Chamaedaphne calyculata	20 (3.9)	--	13 (0.6)	100 (72.9)	--
Gaultheria procumbens	--	--	--	33 (0.4)	--
Ilex verticillata	--	--	--	13 (0.1)	--
Nemopanthus mucronata	--	--	--	7 (0.4)	--
Rubus hispidus	--	--	--	80 (2.1)	--
Salix spp.	--	--	--	--	p
Spiraea alba	--	7 (0.2)	--	--	--

Appendix 2.19-23 Vegetation Summary for Sites in the Manistee Subdistrict, Continued

Appendix 2.19-23 Vegetation Summary, Continued.

	Stone Road	**Forest Hill Road**	**Nurnberg Road**	**Nurnberg Bog**	**Nordhouse Marsh**[2]
Transect Length (m)	95	70	30	70	--
Number of Plots	(n = 20)	(n = 15)	(n = 15)	(n = 15)	--
Trees					
Pinus strobus	--	--	--	7 (0.1)	--
Miscellaneous					
Water coverage	100 (100.0)	100 (100.0)	100 (100.0)	--	--
Water depth (cm)	100 (26.9)	100 (33.3)	100 (33.5)	--	--
Sphagnum moss	--	--	--	100 (57.1)	--

[1] Values are frequency (%), mean percent coverage is in parentheses
[2] Species list was compiled but not sampled quantitatively

Appendix 3. Soils Data for Sampling Sites

Appendix 3.1 Soils Data From Beaumont

Beaumont			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-150	SM	0-150

depth	pH	depth	pH
0	7.0		
30	7.0		
50	7.2		
100	7.4		

Appendix 3.2 Soils Data From Cassidy

Cassidy					
Transect 1		Transect 2		Transect 3	
substrate	depth	substrate	depth	substrate	depth
SM	0-90	SM	0-110	SM	0-130
MFS	90-150	HM	110-145	MFS	130-150
		Marl	145-150		

depth	pH	depth	pH	depth	pH
0	7.2	0	7.0	0	7.0
30	7.2	30	7.0	50	7.0
50	7.0	50	7.5	100	7.5
100	7.7	100	7.5	130	7.5
		150	7.6		

Appendix 3.3 Soils Data From Emery Road

Embury East				Embury West	
Transect 1		Transect 2		Transect 1	
substrate	depth	substrate	depth	substrate	depth
SM	0-80	SM	0-120	SM	0-150
SiC	80-100	HM	120-150		

depth	pH	depth	pH	depth	pH
0	7.4	0	7.0	0	7.0
50	7.4	50	7.2	50	7.2
100	7.8	100	7.2	100	7.4
		150	7.4	150	7.8

Appendix 3.4 Soils Data From Harr Road

Harr Road			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-150	SM	0-60
		HM	60-100
		SM	100-150

depth	pH	depth	pH
0	7.2		
50	7.4		
100	7.4		

Appendix 3.5 Soils Data From Huron Meadow

Huron Meadow							
Transect 1		Transect 2		Transect 3		Transect 4	
substrate	depth	substrate	depth	substrate	depth	substrate	depth
SiL	0-60	SM	0-150	SM	0-90	SM	0-60
SL	60-100			Marl	90-150	HM	60-90
						FM	90-150
depth	pH	depth	pH	depth	pH	depth	pH
0	7.4	0	7.4	0	7.4	0	7.6
50	7.6	50	7.4	50	7.8	50	7.8
75	7.8	100	7.8	100	8.0	100	7.8
		150	7.8	150	8.0	150	7.8

Appendix 3.6 Soils Data From Irwin's

Irwin's	
Transect 1	
substrate	depth
SM	0-20
HM	20-40
SM&HM	40-150
depth	pH
0	7.6
30	7.2
50	7.2
100	7.2

Appendix 3.7 Soils Data From Leeke Road

Leeke					
Transect 1		Transect 2		Transect 3	
substrate	depth	substrate	depth	substrate	depth
SM	0-150	SM	0-150	SM	0-150

depth	pH	depth	pH	depth	pH
0	7.0				
35	7.0				
50	7.0				
100	7.2				
150	7.4				

Appendix 3.8 Soils Data From Livingston

Livingston			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-30	SM	0-40
HM(FM)	30-90	MFS	40-150
SM	90-120		

depth	pH	depth	pH
0	7.2	0	7.2
30	7.2	50	7.6
50	7.5	100	7.6
100	7.5		

Appendix 3.9 Soils Data From M-59

M59			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-80	SM	0-30
MS	80-150	FM	30-150
depth	pH	depth	pH
0	7.0	0	5.5
50	7.2	50	5.8
100	7.8	100	6.0
150	7.8		

Appendix 3.10 Soils Data From Maute Road

Maute							
Transect 1		Transect 2		Transect 3		Transect 4	
substrate	depth	substrate	depth	substrate	depth	substrate	depth
SM	0-80	SM	0-110	SM	0-50	HM	0-100
HM	80-110	FS(marly)	110-130	MFS	50-150	Marl	100-150
SM	110-150	FS	130-150				
depth	pH	depth	pH	depth	pH	depth	pH
				0	7.0		
				30	7.2		
				50	7.6		
				100	8.0		

Appendix 3.11 Soils Data From Orr Road

Orr	
Transect 1	
substrate	depth
SM	0-20
FM	20-150

depth	pH
0	4.5
50	5.0
100	5.3
150	6.0

Appendix 3.12 Soils Data From Rank Road

Rank Road			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-70	SM	0-20
C	70-90	MS	20-30
MS	90-150	HM	30-150

depth	pH	depth	pH
0	4.8	0	4.8
30	7.0	25	7.0
50	7.8	50	7.2
100	7.8	100	7.2
		150	7.5

Appendix 3.13 Soils Data From Teeple Lake

Teeple Lake			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-120	SM	0-20
C	120-150	HM	20-100

depth	pH	depth	pH
0	7.0	0	7.0
35	7.0	50	7.4
50	7.2	100	7.6
100	7.4		
130	7.8		

Appendix 3.14 Soils Data From Thread Creek

Thread Creek			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-150	SM	0-150
		very loose upper 30 cm	

depth	pH	depth	pH
0	6.2	0	7.4
50	7.4	50	7.8
100	7.8	100	7.8
150	7.8		

Appendix 3.15 Soils Data From Waterbury

Waterbury			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-150	SM	0-150

depth	pH	depth	pH
0	7.4		
30	7.0		
50	7.0		
100	7.0		

Appendix 3.16 Soils Data From Waterford Kettering

Waterford Kettering	
Transect 1	
substrate	depth
SM	0-20
FM	20-150

depth	pH
0	5.3
50	5.8
100	6.2

Appendix 3.17 Soils Data From Waterloo Munith

Waterloo-Munith			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-20	SM	0-30
HM	20-150	SiL	30-70
		FS	70-150
depth	pH	depth	pH
0	7.0	0	7.2
50	7.6	50	7.6
100	7.8	100	8.0
150	7.8	150	8.0

Appendix 3.18 Soils Data From Williamsville

Williamsville			
Transect 1		Transect 2	
substrate	depth	substrate	depth
SM	0-30	SM	0-40
SiL	30-60	SiL	40-70
Marl	60-150	Marl	70-150
depth	pH	depth	pH
0	7.5	0	7.0
50	7.8	50	7.4
700	7.8	100	7.8
		150	8.0

Appendix 3.19 – 3.22 Soils Data From Stone Road, Forest Hill Road, Nurnberg Road, Nurnberg Bog

	Stone Road		Forest Hill Road		Nurnberg Road		Nurnberg Bog	
Substrate[1]	substrate	depth	substrate	depth	substrate	depth	substrate	depth
	MS	0-100	MS	0-100	MS	0-100	FM	0-20
							SM	20-40
							SiL	40-80
							MS	80-100
pH	depth	pH	depth	pH	depth	pH	depth	pH
	0	4.3	0	4.5	0	5.8	0	4.0
	40	4.5	50	4.8	30	6.0	30	4.0
	50	5.0	100	5.0	50	6.2	50	4.3
							100	5.0

[1] MS = Medium Sand, FM = Fibric Muck, SM = Sapric Muck, SiL = Silt Loam

Appendix 4 TWINSPAN Output

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NUMBER OF SAMPLES    43

NUMBER OF SPECIES   189

LENGTH OF RAW DATA ARRAY  1853
       3     22200         4      6500         5      3500         8       200         9       100        11      2900
      12       100        14       100        15      1000        17       100        18       200        20       600
      22       300        24       100        25       100        26       600        27       200        28       100
      29       300        30      1400        32       200        33      2700        35       100        37      1200
      38      5200        -1         3     22800         4     22100         5      6000         7       100        11
     600        15       400        17       300        18       300        20       300        22       300        25
     300        30      1300        31      1400        32       500        36       300        37      7200        38
    3100        39       100        -1         1     12600         2       200         3     18800         4       300
       6       100         9      1100        13       400        16     18400        17       200        18       400
      19       100        20       500        21      5100        38       300        -1        42       100        45
  .......................................................................................................................
     200        72      1000        74      1500        81       100        89       700       102     11100       109
    4100       114       100       124       300       126       300       129      5200       132       800       139
     100       143       300       144       100       148      2400       160       100       164       100       172
    1600       174       700       175       100       179     49300        -1        45      8400        56       500
      66      3900        90       200       170     25900       183       200        -1        45      4200        50
    1200        56      1300        90      1100        98       100       103       300       128       300       170
    6600       171       200        -1        66       600        98       100       110       300       114       100
     128     28100       158       100       180      6100        -1        26       100        56       400        58
     400        62       600        66     72900       101       100       118      1600       121       400       130
     100       146      2100       158       400       178       100       184     19900       189      3700        -1

SPECIES NAMES
   1 acer  neg!   2 acer  rub!   3 acer  sac!   4 acer  spi!   5 achi  mil!   6 acor  cal!   7 agri  gry!   8 agro  rep
   9 agrs  hye!  10 agrs  sto!  11 alga e sp!  12 alis  pla!  13 alli  can!  14 alnu  rug!  15 alop  aeq!  16 amel  spp
  17 amph  bra!  18 andr  gla!  19 anem  can!  20 apio  ame!  21 apoc  and!  22 apoc  sib!  23 aral  nud!  24 aris  tri
  25 armo  lac!  26 aron  mel!  27 ascl  inc!  28 ascl  syr!  29 astr  bor!  30 astr  cil!  31 astr  dum!  32 astr  jun
  33 astr  lae!  34 astr  lan!  35 astr  lat!  36 astr  lon!  37 astr  mac!  38 astr  nov!  39 astr  pun!  40 betu  pum
  41 bide  con!  42 bide  cor!  43 boeh  cyl!  44 brom  cil!  45 cala  can!  46 call  pal!  47 calt  pal!  48 caly  sep
  49 camp  apa!  50 carx  aqu!  51 carx  beb!  52 carx  com!  53 carx  dia!  54 carx  hys!  55 carx  lac!  56 carx  las
  57 carx  lep!  58 carx  pac!  59 carx  sar!  60 carx  spp!  61 carx  sti!  62 carx  str!  63 carx  vul!  64 carp  car
  65 ceph  occ!  66 cham  cal!  67 chel  gla!  68 cicu  bul!  69 cicu  mac!  70 cirs  arv!  71 clad  mar!  72 corn  amo
  73 corn  foe!  74 corn  sto!  75 cory  ame!  76 cusc  gro!  77 dryo  cri!  78 elae  umb!  79 eleo  aci!  80 eleo  ell
  81 eleo  ery!  82 eleo  sma!  83 epil  col!  84 epil  lep!  85 equi  arv!  86 equi  flu!  87 erec  hie!  88 eupa  mac
  89 eupa  per!  90 euth  gra!  91 frag  vir!  92 frax  nig!  93 frax  pen!  94 gali  asp!  95 gali  tin!  96 gali  trf
  97 geum  can!  98 glyc  bor!  99 hydo  ame! 100 hype  sp.! 101 ilex  ver! 102 impa  cap! 103 iris  vir! 104 junc  dud
 105 junc  eff! 106 junc  nod! 107 junc  ten! 108 lath  pal! 109 leer  ory! 110 lemn  min! 111 lemn  tri! 112 lyco  ann
 113 lycp  ame! 114 lycp  uni! 115 lysi  cil! 116 lyth  sal! 117 ment  arv! 118 meny  tri! 119 mite  nud! 120 muhl  glo
 121 nemo  muc! 122 nuph  adv! 123 nymp  odo! 124 onoc  sen! 125 osmu  reg! 126 part  qui! 127 pelt  vir! 128 phal  aru
 129 pile  pum! 130 pinu  str! 131 poly  amp! 132 poly  hyd! 133 pota  ill! 134 pote  fru! 135 pote  pal! 136 pros  pal
 137 pycn  vir! 138 pyro  ell! 139 rham  fra! 140 rhyn  cap! 141 ribe  ame! 142 ribe  cyn! 143 ribe  hir! 144 rori  pal
 145 rosa  pal! 146 rubu  his! 147 rubu  pub! 148 rubu  str! 149 sagi  lat! 150 salx  can! 151 salx  dis! 152 salx  exi
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 153 salx  pet! 154 salx  ses! 155 samb  can! 156 scir  acu! 157 scir  atr! 158 scir  cyp! 159 scir  val! 160 scut  gal
 161 scut  lat! 162 sene  aur! 163 sium  sua! 164 sola  dul! 165 soli  alc! 166 soli  gig! 167 soli  pat! 168 soli  rug
 169 spar  eur! 170 sprt  pec! 171 spir  alb! 172 symp  foe! 173 thal  das! 174 thel  pal! 175 toxi  rad! 176 toxi  ver
 177 tria  fra! 178 trie  bor! 179 typh  ang! 180 typh  lat! 181 ulmu  ame! 182 urti  dio! 183 utri  vul! 184 vacc  ang
 185 vacc  oxy! 186 vibu  len! 187 viol  cuc! 188 viti  rip! 189 wood  vir!


SAMPLE-UNIT NAMES
   1 MAU1     !   2 MAU2     !   3 MAU3     !   4 LEE1     !   5 LEE2     !   6 LEE3     !   7 BEA1     !   8 BEA2
   9 WAT1     !  10 WAT2     !  11 CAS1     !  12 CAS2     !  13 CAS3     !  14 TEE1     !  15 TEE2     !  16 LIV1
  17 LIV2     !  18 EMW      !  19 EME1     !  20 EME2     !  21 HAR1     !  22 HAR2     !  23 WAM1     !  24 WAM2
  25 WFK      !  26 HM1      !  27 HM2      !  28 HM3      !  29 HM4      !  30 M591     !  31 M592     !  32 ORR
  33 IRW      !  34 RAN1     !  35 RAN2     !  36 WIL1     !  37 WIL2     !  38 THR1     !  39 THR2     !  40 SR
  41 FHR      !  42 NR       !  43 NB       !


DO YOU WISH TO OMIT SOME SAMPLE UNITS?
ENTER NUMBERS (NOT NAMES) OF ITEMS TO BE OMITTED
ONE PER CARD, ENDING LIST WITH A -1.
OTHER NEGATIVE NUMBERS DENOTE SEQUENCES.  FOR EXAMPLE
A 4 FOLLOWED BY A -8 OMITS ITEMS 4 THROUGH 8.
             -1

ENTER NUMBER (NOT EXCEEDING 9) OF PSEUDOSPCIES CUT LEVELS
OR TYPE -1 FOR DEFAULT CUT LEVELS (0 2 5 10 20):
ANSWER = -1

CUT LEVELS:
    0.00     2.00     5.00    10.00    20.00


ENTER MINIMUM GROUP SIZE FOR DIVISION.
TYPE -1 FOR DEFAULT VALUE ( =  5);  OTHERWISE TYPE (INTEGER) VALUE REQUIRED,
WHICH MUST NOT LIE OUTSIDE LIMITS      2 10000:
ANSWER=   -1
VALUE SET TO    5 BY DEFAULT


ENTER MAXIMUM NUMBER OF INDICATORS PER DIVISION.
TYPE -1 FOR DEFAULT VALUE ( =  7);  OTHERWISE TYPE (INTEGER) VALUE REQUIRED,
WHICH MUST NOT LIE OUTSIDE LIMITS      0    15:
ANSWER=   -1
VALUE SET TO    7 BY DEFAULT


ENTER MAXIMUM NUMBER OF SPECIES IN FINAL TABULATION.
TYPE -1 FOR DEFAULT VALUE ( =100);  OTHERWISE TYPE (INTEGER) VALUE REQUIRED,
WHICH MUST NOT LIE OUTSIDE LIMITS      0   189:
```

```
        -1

  MAXIMUM NUMBER OF PSEUDOSPECIES POSSIBLE:   2463
  LENGTH OF DATA ARRAY AFTER DEFINING PSEUDOSPECIES:   1354
  TOTAL NUMBER OF PSEUDOSPECIES AND SPECIES:    307
  NUMBER OF SPECIES (EXCLUDING NO OCCURANCES):    177

************************************************************************************************************************
     DIVISION    1  (N=  43)    I.E. GROUP *

EIGENVALUE 0.829  AT ITERATION   2
INDICATORS, TOGETHER WITH THEIR SIGN
acer  spi1(+)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1

ITEMS IN NEGATIVE GROUP   2  (N=   40)         I.E. GROUP *0
LEE1      LEE2      LEE3      BEA1      BEA2      WAT1      WAT2      CAS1      CAS2      CAS3      TEE1      TEE2
LIV1      LIV2      EMW       EME1      EME2      HAR1      HAR2      WAM1      WAM2      WFK       HM1       HM2
HM3       HM4       M591      M592      ORR       IRW       RAN1      RAN2      WIL1      WIL2      THR1      THR2
SR        FHR       NR        NB

ITEMS IN POSITIVE GROUP   3  (N=    3)         I.E. GROUP *1
MAU1      MAU2      MAU3

NEGATIVE PREFERENTIALS
bide  cor1( 12,  0) cala  can1( 31,  0) camp  apa1( 23,  0) carx  com1( 10,  0) carx  lac1( 21,  0) carx  las1( 22,  0)
carx  str1( 25,  0) cicu  bul1( 22,  0) corn  sto1( 15,  0) eleo  ery1( 12,  0) eupa  mac1( 18,  0) eupa  per1( 12,  0)
gali  tin1( 28,  0) impa  cap1( 16,  0) leer  ory1(  9,  0) lycp  uni1( 29,  0) lyth  sal1( 11,  0) ment  arv1( 14,  0)
onoc  sen1( 21,  0) phal  aru1( 13,  0) poly  amp1( 24,  0) pote  pal1(  9,  0) sagi  lat1( 15,  0) scut  gal1( 23,  0)
sola  dul1( 10,  0) soli  alc1( 11,  0) spir  alb1( 13,  0) thel  pal1( 31,  0) typh  lat1( 27,  0) cala  can2( 14,  0)
carx  lac2( 13,  0) carx  las2( 12,  0) carx  str2( 16,  0) lyth  sal2(  9,  0) sagi  lat2(  9,  0) thel  pal2( 14,  0)
typh  lat2( 14,  0) cala  can3(  9,  0) carx  lac3( 10,  0) carx  las3( 10,  0) carx  str3( 13,  0) carx  str4( 10,  0)

POSITIVE PREFERENTIALS
acer  neg1(  0,  1) acer  rub1(  0,  1) acer  sac1(  2,  3) acer  spi1(  0,  3) achi  mil1(  0,  2) acor  cal1(  1,  1)
agri  gry1(  0,  1) agro  rep1(  0,  1) agrs  hye1(  0,  2) alga e sp1(  0,  2) alis  pla1(  0,  1) alli  can1(  0,  1)
alnu  rug1(  1,  1) alop  aeq1(  0,  2) amel  spp1(  0,  1) amph  bra1(  0,  3) andr  gla1(  0,  3) anem  can1(  0,  1)
apio  ame1(  3,  3) apoc  and1(  0,  1) apoc  sib1(  0,  2) aris  tri1(  0,  1) armo  lac1(  0,  2) aron  mel1(  1,  1)
ascl  syr1(  0,  1) astr  bor1(  4,  1) astr  cil1(  0,  2) astr  dum1(  0,  1) astr  jun1(  0,  2) astr  lae1(  0,  1)
astr  lat1(  0,  1) astr  lon1(  0,  1) astr  mac1(  0,  2) astr  nov1(  0,  3) acer  neg2(  0,  1) acer  sac2(  0,  3)
acer  spi2(  0,  2) achi  mil2(  0,  2) alga e sp2(  0,  1) amel  spp2(  0,  1) apoc  and2(  0,  1) astr  lae2(  0,  1)
astr  mac2(  0,  1) astr  nov2(  0,  2) acer  neg3(  0,  1) acer  sac3(  0,  3) acer  spi3(  0,  2) achi  mil3(  0,  1)
amel  spp3(  0,  1) apoc  and3(  0,  1) astr  mac3(  0,  1) astr  nov3(  0,  1) acer  neg4(  0,  1) acer  sac4(  0,  3)
acer  spi4(  0,  1) amel  spp4(  0,  1) acer  sac5(  0,  2) acer  spi5(  0,  1)

NON-PREFERENTIALS
ascl  inc1(  7,  1) astr  pun1( 17,  1)
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  END OF LEVEL   1

*****************************************************************************************************************
     DIVISION    2  (N=  40)    I.E. GROUP *0

EIGENVALUE 0.514  AT ITERATION   2
INDICATORS, TOGETHER WITH THEIR SIGN
aron  mel1(-)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0

ITEMS IN NEGATIVE GROUP   4  (N=    1)         I.E. GROUP *00
NB

ITEMS IN POSITIVE GROUP   5  (N=   39)         I.E. GROUP *01
LEE1     LEE2     LEE3      BEA1     BEA2      WAT1     WAT2     CAS1     CAS2     CAS3     TEE1     TEE2
LIV1     LIV2     EMW       EME1     EME2      HAR1     HAR2     WAM1     WAM2     WFK      HM1      HM2
HM3      HM4      M591      M592     ORR       IRW      RAN1     RAN2     WIL1     WIL2     THR1     THR2
SR       FHR      NR

NEGATIVE PREFERENTIALS
aron  mel1(  1,   0) carx  pac1(  1,   0) cham  cal1(  1,   3) ilex  ver1(  1,   2) meny  tri1(  1,   1) nemo  muc1(  1,   0)
pinu  str1(  1,   0) rubu  his1(  1,   0) scir  cyp1(  1,   1) trie  bor1(  1,   0) vacc  ang1(  1,   0) wood  vir1(  1,   0)
cham  cal2(  1,   1) rubu  his2(  1,   0) vacc  ang2(  1,   0) wood  vir2(  1,   0) cham  cal3(  1,   0) vacc  ang3(  1,   0)
cham  cal4(  1,   0) vacc  ang4(  1,   0) cham  cal5(  1,   0)

POSITIVE PREFERENTIALS
astr  pun1(  0, 17) bide  cor1(  0, 12) cala  can1(  0, 31) camp  apa1(  0, 23) carx  com1(  0, 10) carx  lac1(  0, 21)
cicu  bul1(  0, 22) corn  sto1(  0, 15) eleo  ery1(  0, 12) eupa  mac1(  0, 18) eupa  per1(  0, 12) gali  tin1(  0, 28)
impa  cap1(  0, 16) iris  vir1(  0,   8) leer  ory1(  0,   9) lycp  ame1(  0,   8) lycp  uni1(  0, 29) lyth  sal1(  0, 11)
ment  arv1(  0, 14) onoc  sen1(  0, 21) phal  aru1(  0, 13) poly  amp1(  0, 24) pote  pal1(  0,   9) sagi  lat1(  0, 15)
scut  gal1(  0, 23) sola  dul1(  0, 10) soli  alc1(  0, 11) spir  alb1(  0, 13) thel  pal1(  0, 31) typh  lat1(  0, 27)
cala  can2(  0, 14) carx  lac2(  0, 13) carx  las2(  0, 12) carx  str2(  0, 16) eupa  mac2(  0,   8) lyth  sal2(  0,   9)
sagi  lat2(  0,   9) thel  pal2(  0, 14) typh  lat2(  0, 14) cala  can3(  0,   9) carx  lac3(  0, 10) carx  las3(  0, 10)
carx  str3(  0, 13) lyth  sal3(  0,   8) carx  las4(  0,   8) carx  str4(  0, 10)

NON-PREFERENTIALS
carx  las1(  1, 21) carx  str1(  1, 24)
*****************************************************************************************************************
     DIVISION    3  (N=   3)    I.E. GROUP *1

     DIVISION FAILS - THERE ARE TOO FEW ITEMS


  END OF LEVEL   2

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     DIVISION    4  (N=   1)    I.E. GROUP *00

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

************************************************************************************************************************
     DIVISION    5  (N=  39)    I.E. GROUP *01

EIGENVALUE 0.428  AT ITERATION   3
INDICATORS, TOGETHER WITH THEIR SIGN
thel  pal1(+)   gali  tin1(+)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1

ITEMS IN NEGATIVE GROUP  10  (N=    5)         I.E. GROUP *010
WAM1      ORR       SR        FHR       NR

BORDERLINE NEGATIVES    (N=    1)
WAM1

ITEMS IN POSITIVE GROUP  11  (N=   34)         I.E. GROUP *011
LEE1      LEE2      LEE3      BEA1      BEA2      WAT1      WAT2      CAS1      CAS2      CAS3      TEE1      TEE2
LIV1      LIV2      EMW       EME1      EME2      HAR1      HAR2      WAM2      WFK       HM1       HM2       HM3
HM4       M591      M592      IRW       RAN1      RAN2      WIL1      WIL2      THR1      THR2

BORDERLINE POSITIVES    (N=    1)
HAR1

NEGATIVE PREFERENTIALS
cham  cal1(  3,  0) euth  gra1(  2,  0) glyc  bor1(  2,  1) phal  aru1(  3, 10) sprt  pec1(  2,  0) cala  can2(  4, 10)
phal  aru2(  2,  3) sprt  pec2(  2,  0) phal  aru3(  2,  2) sprt  pec3(  2,  0) phal  aru4(  2,  2)

POSITIVE PREFERENTIALS
ascl  inc1(  0,  7) astr  pun1(  0, 17) bide  cor1(  0, 12) camp  apa1(  1, 22) carx  com1(  0, 10) carx  hys1(  0,  7)
carx  lac1(  1, 20) carx  str1(  0, 24) cicu  bul1(  0, 22) corn  amo1(  0,  7) corn  sto1(  0, 15) eupa  mac1(  0, 18)
eupa  per1(  0, 12) gali  tin1(  0, 28) impa  cap1(  1, 15) leer  ory1(  0,  9) lycp  ame1(  0,  8) lyth  sal1(  0, 11)
ment  arv1(  0, 14) onoc  sen1(  0, 21) pile  pum1(  0,  7) poly  amp1(  1, 23) pote  pal1(  0,  9) sagi  lat1(  0, 15)
scut  gal1(  1, 22) soli  alc1(  0, 11) thel  pal1(  0, 31) carx  lac2(  0, 13) carx  str2(  0, 16) eupa  mac2(  0,  8)
lyth  sal2(  0,  9) onoc  sen2(  0,  7) sagi  lat2(  0,  9) thel  pal2(  0, 14) carx  lac3(  0, 10) carx  str3(  0, 13)
lyth  sal3(  0,  8) carx  str4(  0, 10) carx  str5(  0,  7)

NON-PREFERENTIALS
cala  can1(  4, 27) carx  las1(  3, 18) eleo  ery1(  1, 11) iris  vir1(  1,  7) lycp  uni1(  2, 27) sola  dul1(  1,  9)
spir  alb1(  1, 12) typh  lat1(  2, 25) carx  las2(  1, 11) typh  lat2(  2, 12) cala  can3(  2,  7) carx  las3(  1,  9)
carx  las4(  1,  7)

  END OF LEVEL   3

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     DIVISION   10  (N=   5)    I.E. GROUP *010

EIGENVALUE 0.802  AT ITERATION   1
INDICATORS, TOGETHER WITH THEIR SIGN
carx  las1(-)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0

ITEMS IN NEGATIVE GROUP  20  (N=    3)         I.E. GROUP *0100
ORR       SR        FHR

ITEMS IN POSITIVE GROUP  21  (N=    2)         I.E. GROUP *0101
WAM1      NR
NEGATIVE PREFERENTIALS
cala  can1(  3,  1) carx  aqu1(  1,  0) carx  las1(  3,  0) clad  mar1(  1,  0) eleo  ery1(  1,  0) eleo  sma1(  1,  0)
euth  gra1(  2,  0) hype  sp.1(  1,  0) iris  vir1(  1,  0) junc  dud1(  1,  0) junc  nod1(  1,  0) rhyn  cap1(  1,  0)
sprt  pec1(  2,  0) spir  alb1(  1,  0) tria  fra1(  1,  0) utri  vul1(  1,  0) cala  can2(  3,  1) carx  las2(  1,  0)
cham  cal2(  1,  0) lycp  uni2(  1,  0) rhyn  cap2(  1,  0) sprt  pec2(  2,  0) carx  las3(  1,  0) sprt  pec3(  2,  0)
carx  las4(  1,  0) sprt  pec4(  1,  0) carx  las5(  1,  0) sprt  pec5(  1,  0)

POSITIVE PREFERENTIALS
camp  apa1(  0,  1) carx  lac1(  0,  1) impa  cap1(  0,  1) lemn  min1(  0,  1) nuph  adv1(  0,  1) pelt  vir1(  0,  1)
phal  aru1(  1,  2) poly  amp1(  0,  1) scir  acu1(  0,  1) scir  cyp1(  0,  1) scut  gal1(  0,  1) sola  dul1(  0,  1)
spar  eur1(  0,  1) typh  lat1(  0,  2) pelt  vir2(  0,  1) phal  aru2(  0,  2) typh  lat2(  0,  2) phal  aru3(  0,  2)
typh  lat3(  0,  1) cala  can4(  0,  1) phal  aru4(  0,  2) cala  can5(  0,  1) phal  aru5(  0,  1)

NON-PREFERENTIALS
cham  cal1(  2,  1) glyc  bor1(  1,  1) lycp  uni1(  1,  1) cala  can3(  1,  1)
*******************************************************************************************************************
     DIVISION   11  (N=  34)    I.E. GROUP *011

EIGENVALUE 0.402  AT ITERATION   2
INDICATORS, TOGETHER WITH THEIR SIGN
carx  las1(-)   astr  pun1(+)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1

ITEMS IN NEGATIVE GROUP  22  (N=   20)         I.E. GROUP *0110
LEE1      LEE2      LEE3      BEA1      BEA2      CAS1      CAS2      CAS3      LIV2      EMW       EME1      EME2
HAR1      WAM2      WFK       M591      M592      RAN1      RAN2      WIL1

BORDERLINE NEGATIVES    (N=    2)
LIV2      WFK

ITEMS IN POSITIVE GROUP  23  (N=   14)         I.E. GROUP *0111
WAT1      WAT2      TEE1      TEE2      LIV1      HAR2      HM1       HM2       HM3       HM4       IRW       WIL2
THR1      THR2

NEGATIVE PREFERENTIALS
bide  cor1(  9,  3) carx  com1(  9,  1) carx  las1( 18,  0) cicu  bul1( 17,  5) eleo  ery1(  9,  2) iris  vir1(  6,  1)
lycp  ame1(  6,  2) poly  amp1( 18,  5) pote  pal1(  8,  1) sagi  lat1( 15,  0) salx  exi1(  5,  1) cala  can2( 10,  0)
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carx  las2( 11,  0) sagi  lat2(  9,  0) typh  lat2(  9,  3) cala  can3(  7,  0) carx  las3(  9,  0) carx  las4(  7,  0)

POSITIVE PREFERENTIALS
apio  ame1(  0,  3) ascl  incl(  2,  5) astr  bor1(  1,  3) astr  pun1(  3, 14) calt  pal1(  1,  4) cicu  mac1(  0,  3)
corn  amo1(  0,  7) corn  foe1(  0,  4) corn  sto1(  2, 13) equi  arv1(  0,  3) eupa  mac1(  5, 13) eupa  per1(  4,  8)
gali  asp1(  0,  4) impa  cap1(  6,  9) onoc  sen1(  8, 13) part  qui1(  0,  4) pote  fru1(  0,  3) pycn  vir1(  0,  3)
rham  fra1(  0,  3) ribe  ame1(  0,  3) ribe  hir1(  0,  5) rubu  pub1(  0,  5) samb  can1(  0,  3) soli  alc1(  3,  8)
soli  pat1(  0,  3) symp  foe1(  0,  5) toxi  ver1(  0,  4) astr  pun2(  0,  4) corn  amo2(  0,  4) corn  sto2(  0,  5)
eupa  mac2(  0,  8) impa  cap2(  0,  6) onoc  sen2(  0,  7) soli  alc2(  0,  3) carx  lac3(  4,  6) carx  str3(  4,  9)
impa  cap3(  0,  3) onoc  sen3(  0,  4) carx  str4(  3,  7) carx  str5(  1,  6)

NON-PREFERENTIALS
cala  can1( 18,  9) camp  apa1( 14,  8) carx  hys1(  5,  2) carx  lac1( 10, 10) carx  str1( 14, 10) gali  tin1( 19,  9)
leer  ory1(  6,  3) lycp  uni1( 15, 12) lyth  sal1(  6,  5) ment  arv1(  8,  6) phal  aru1(  6,  4) pile  pum1(  3,  4)
scut  gal1( 14,  8) sola  dul1(  5,  4) spir  alb1(  6,  6) thel  pal1( 17, 14) typh  lat1( 17,  8) carx  lac2(  6,  7)
carx  str2(  7,  9) lyth  sal2(  5,  4) thel  pal2(  6,  8) lyth  sal3(  5,  3) carx  lac4(  3,  3)


  END OF LEVEL   4


************************************************************************************************************************
     DIVISION   20  (N=   3)    I.E. GROUP *0100

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

************************************************************************************************************************
     DIVISION   21  (N=   2)    I.E. GROUP *0101

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

************************************************************************************************************************
     DIVISION   22  (N=  20)    I.E. GROUP *0110

EIGENVALUE 0.322  AT ITERATION   3
INDICATORS, TOGETHER WITH THEIR SIGN
junc  eff1(-)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP   -1     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    0

ITEMS IN NEGATIVE GROUP  44  (N=    2)         I.E. GROUP *01100
RAN1      RAN2

ITEMS IN POSITIVE GROUP  45  (N=   18)         I.E. GROUP *01101
LEE1      LEE2      LEE3      BEA1      BEA2      CAS1      CAS2      CAS3      LIV2      EMW       EME1      EME2
HAR1      WAM2      WFK       M591      M592      WIL1

NEGATIVE PREFERENTIALS
carx  com1(  2,  7) carx  vul1(  1,  0) eleo  ell1(  2,  2) eleo  ery1(  2,  7) junc  eff1(  2,  0) nymp  odo1(  2,  0)
poly  hyd1(  2,  1) pota  ill1(  1,  0) scir  atr1(  1,  1) scir  val1(  1,  3) junc  eff2(  1,  0) leer  ory2(  1,  0)
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```
nymp  odo2(  2,  0) poly  amp2(  1,  0) poly  hyd2(  1,  0) junc  eff3(  1,  0) nymp  odo3(  1,  0) poly  amp3(  1,  0)
cala  can4(  1,  2) junc  eff4(  1,  0) cala  can5(  1,  1) junc  eff5(  1,  0)

POSITIVE PREFERENTIALS
bide  cor1(  0,  9) camp  apa1(  0, 14) carx  hys1(  0,  5) epil  lep1(  0,  4) eupa  mac1(  0,  5) eupa  per1(  0,  4)
impa  cap1(  0,  6) iris  vir1(  0,  6) lyth  sal1(  0,  6) onoc  sen1(  0,  8) pote  pal1(  0,  8) salx  dis1(  0,  4)
salx  exi1(  0,  5) salx  ses1(  0,  4) scut  gal1(  0, 14) sola  dul1(  0,  5) spir  alb1(  0,  6) thel  pal1(  0, 17)
tria  fra1(  0,  4) carx  lac2(  0,  6) carx  str2(  0,  7) eleo  ery2(  0,  4) lyth  sal2(  0,  5) sagi  lat2(  0,  9)
thel  pal2(  0,  6) typh  lat2(  0,  9) carx  lac3(  0,  4) carx  las3(  0,  9) carx  str3(  0,  4) eleo  ery3(  0,  4)
lyth  sal3(  0,  5) carx  las4(  0,  7)

NON-PREFERENTIALS
cala  can1(  2, 16) carx  lac1(  1,  9) carx  las1(  1, 17) carx  str1(  1, 13) cicu  bul1(  1, 16) gali  tin1(  2, 17)
leer  ory1(  1,  5) lycp  ame1(  1,  5) lycp  uni1(  1, 14) ment  arv1(  1,  7) phal  aru1(  1,  5) poly  amp1(  2, 16)
sagi  lat1(  1, 14) typh  lat1(  1, 16) cala  can2(  1,  9) carx  las2(  1, 10) cala  can3(  1,  6)
************************************************************************************************************************
     DIVISION   23  (N=  14)    I.E. GROUP *0111

EIGENVALUE 0.366  AT ITERATION   2
INDICATORS, TOGETHER WITH THEIR SIGN
bide  con1(+)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1

ITEMS IN NEGATIVE GROUP  46  (N=   13)        I.E. GROUP *01110
WAT1     WAT2     TEE1     TEE2     LIV1     HAR2     HM1      HM2      HM3      HM4      IRW      WIL2
THR1

ITEMS IN POSITIVE GROUP  47  (N=    1)        I.E. GROUP *01111
THR2

NEGATIVE PREFERENTIALS
apio  ame1(  3,  0) ascl  inc1(  5,  0) astr  bor1(  3,  0) bide  cor1(  3,  0) cala  can1(  9,  0) calt  pal1(  4,  0)
camp  apa1(  8,  0) carx  lac1( 10,  0) carx  str1( 10,  0) cicu  mac1(  3,  0) corn  foe1(  4,  0) equi  arv1(  3,  0)
eupa  mac1( 13,  0) gali  asp1(  4,  0) gali  tin1(  9,  0) lyth  sal1(  5,  0) ment  arv1(  6,  0) phal  aru1(  4,  0)
poly  amp1(  5,  0) pote  fru1(  3,  0) pycn  vir1(  3,  0) ribe  ame1(  3,  0) rubu  pub1(  5,  0) samb  can1(  3,  0)
soli  alc1(  8,  0) soli  pat1(  3,  0) spir  alb1(  6,  0) toxi  ver1(  4,  0) typh  lat1(  8,  0) astr  pun2(  4,  0)
carx  lac2(  7,  0) carx  str2(  9,  0) corn  amo2(  4,  0) corn  sto2(  5,  0) eupa  mac2(  8,  0) lyth  sal2(  4,  0)
onoc  sen2(  7,  0) soli  alc2(  3,  0) thel  pal2(  8,  0) typh  lat2(  3,  0) carx  lac3(  6,  0) carx  str3(  9,  0)
lyth  sal3(  3,  0) onoc  sen3(  4,  0) carx  lac4(  3,  0) carx  str4(  7,  0) carx  str5(  6,  0)

POSITIVE PREFERENTIALS
bide  con1(  0,  1) carx  spp1(  0,  1) cicu  bul1(  4,  1) corn  amo1(  6,  1) eleo  ery1(  1,  1) leer  ory1(  2,  1)
part  qui1(  3,  1) pile  pum1(  3,  1) poly  hyd1(  1,  1) rham  fra1(  2,  1) ribe  hir1(  4,  1) rori  pal1(  0,  1)
rubu  str1(  1,  1) sola  dul1(  3,  1) symp  foe1(  4,  1) toxi  rad1(  0,  1) typh  ang1(  1,  1) impa  cap2(  5,  1)
leer  ory2(  0,  1) pile  pum2(  1,  1) rubu  str2(  0,  1) typh  ang2(  0,  1) impa  cap3(  2,  1) pile  pum3(  0,  1)
typh  ang3(  0,  1) impa  cap4(  0,  1) typh  ang4(  0,  1) typh  ang5(  0,  1)

NON-PREFERENTIALS
astr  pun1( 13,  1) corn  sto1( 12,  1) eupa  per1(  7,  1) impa  cap1(  8,  1) lycp  uni1( 11,  1) onoc  sen1( 12,  1)
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scut  gal1(  7,   1) thel  pal1( 13,   1)


  END OF LEVEL   5

**********************************************************************************************************************
     DIVISION   44  (N=   2)    I.E. GROUP *01100

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

**********************************************************************************************************************
     DIVISION   45  (N= 18)    I.E. GROUP *01101

EIGENVALUE 0.283  AT ITERATION   3
INDICATORS, TOGETHER WITH THEIR SIGN
carx  las3(-)   onoc  sen1(+)   carx  las2(-)   carx  las4(-)   impa  cap1(+)   lyth  sal1(+)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1
ITEMS IN NEGATIVE GROUP  90  (N=   11)        I.E. GROUP *011010
BEA1      BEA2      CAS1      CAS3      EMW       EME1      EME2      HAR1      M591      M592      WIL1

MISCLASSIFIED NEGATIVES (N=    1)
EME2

ITEMS IN POSITIVE GROUP  91  (N=    7)        I.E. GROUP *011011
LEE1      LEE2      LEE3      CAS2      LIV2      WAM2      WFK

NEGATIVE PREFERENTIALS
epil  lep1(  4,   0) eupa  mac1(  4,   1) leer  ory1(  4,   1) lycp  ame1(  4,   1) phal  aru1(  4,   1) pote  pal1(  7,   1)
salx  exi1(  5,   0) salx  ses1(  4,   0) soli  alc1(  3,   0) carx  las2(  9,   1) carx  str2(  6,   1) eleo  ery2(  4,   0)
salx  exi2(  3,   0) carx  las3(  9,   0) carx  str3(  4,   0) eleo  ery3(  4,   0) carx  las4(  7,   0) carx  str4(  3,   0)

POSITIVE PREFERENTIALS
astr  pun1(  1,   2) carx  lac1(  3,   6) impa  cap1(  1,   5) lyth  sal1(  1,   5) ment  arv1(  3,   4) onoc  sen1(  2,   6)
scir  val1(  1,   2) sola  dul1(  2,   3) spar  eur1(  1,   2) typh  ang1(  0,   3) carx  lac2(  2,   4) lyth  sal2(  1,   4)
spir  alb2(  0,   2) carx  lac3(  1,   3) lyth  sal3(  1,   4) sagi  lat3(  1,   2) typh  lat3(  0,   2) carx  lac4(  1,   2)
lyth  sal4(  0,   3)

NON-PREFERENTIALS
bide  cor1(  6,   3) cala  can1( 10,   6) camp  apa1(  8,   6) carx  com1(  5,   2) carx  hys1(  3,   2) carx  las1( 11,   6)
carx  str1(  9,   4) cicu  bul1( 10,   6) eleo  ery1(  5,   2) eupa  per1(  3,   1) gali  tin1( 11,   6) iris  vir1(  4,   2)
lycp  uni1( 10,   4) poly  amp1( 10,   6) sagi  lat1(  8,   6) salx  dis1(  2,   2) scut  gal1(  9,   5) spir  alb1(  3,   3)
thel  pal1( 10,   7) tria  fra1(  3,   1) typh  lat1(  9,   7) cala  can2(  6,   3) sagi  lat2(  5,   4) thel  pal2(  4,   2)
typh  lat2(  4,   5) cala  can3(  4,   2)
**********************************************************************************************************************
     DIVISION   46  (N= 13)    I.E. GROUP *01110

EIGENVALUE 0.299  AT ITERATION   2
INDICATORS, TOGETHER WITH THEIR SIGN
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acer  sac1(+)
MAXIMUM INDICATOR SCORE FOR NEGATIVE GROUP    0     MINIMUM INDICATOR SCORE FOR POSITIVE GROUP    1

ITEMS IN NEGATIVE GROUP  92  (N=   12)         I.E. GROUP *011100
WAT1      WAT2      TEE1      TEE2      LIV1      HAR2      HM1       HM2       HM3       HM4       IRW       WIL2

ITEMS IN POSITIVE GROUP  93  (N=    1)         I.E. GROUP *011101
THR1

NEGATIVE PREFERENTIALS
ascl  inc1(  5,  0) astr  bor1(  3,  0) bide  cor1(  3,  0) camp  apa1(  8,  0) carx  str1( 10,  0) cicu  bul1(  4,  0)
equi  arv1(  3,  0) gali  tin1(  9,  0) lyth  sal1(  5,  0) poly  amp1(  5,  0) pote  fru1(  3,  0) pycn  vir1(  3,  0)
ribe  hir1(  4,  0) sola  dul1(  3,  0) soli  alc1(  8,  0) spir  alb1(  6,  0) astr  pun2(  4,  0) carx  str2(  9,  0)
eupa  mac2(  8,  0) lyth  sal2(  4,  0) onoc  sen2(  7,  0) soli  alc2(  3,  0) thel  pal2(  8,  0) carx  str3(  9,  0)
lyth  sal3(  3,  0) onoc  sen3(  4,  0) carx  lac4(  3,  0) carx  str4(  7,  0) carx  str5(  6,  0)

POSITIVE PREFERENTIALS
acer  sac1(  0,  1) acor  cal1(  0,  1) alnu  rug1(  0,  1) apio  ame1(  2,  1) calt  pal1(  3,  1) carx  hys1(  1,  1)
carx  sti1(  0,  1) carp  car1(  0,  1) cicu  mac1(  2,  1) corn  amo1(  5,  1) corn  foe1(  3,  1) cory  ame1(  0,  1)
cusc  gro1(  0,  1) elae  umb1(  0,  1) epil  col1(  0,  1) eupa  per1(  6,  1) frax  nig1(  0,  1) gali  asp1(  3,  1)
leer  ory1(  1,  1) ment  arv1(  5,  1) part  qui1(  2,  1) phal  aru1(  3,  1) pile  pum1(  2,  1) rham  fra1(  1,  1)
ribe  ame1(  2,  1) ribe  cyn1(  1,  1) rubu  pub1(  4,  1) salx  dis1(  1,  1) samb  can1(  2,  1) scut  gal1(  6,  1)
soli  pat1(  2,  1) soli  rug1(  1,  1) symp  foe1(  3,  1) toxi  ver1(  3,  1) typh  ang1(  0,  1) vibu  len1(  1,  1)
acor  cal2(  0,  1) carx  lac2(  6,  1) corn  amo2(  3,  1) corn  foe2(  1,  1) corn  sto2(  4,  1) elae  umb2(  0,  1)
impa  cap2(  4,  1) salx  dis2(  1,  1) soli  pat2(  0,  1) symp  foe2(  1,  1) toxi  ver2(  0,  1) typh  lat2(  2,  1)
carx  lac3(  5,  1) corn  amo3(  1,  1) impa  cap3(  1,  1) symp  foe3(  0,  1) typh  lat3(  1,  1)

NON-PREFERENTIALS
astr  pun1( 12,  1) cala  can1(  8,  1) carx  lac1(  9,  1) corn  sto1( 11,  1) eupa  mac1( 12,  1) impa  cap1(  7,  1)
lycp  uni1( 10,  1) onoc  sen1( 11,  1) thel  pal1( 12,  1) typh  lat1(  7,  1)
*************************************************************************************************************************
     DIVISION   47  (N=   1)    I.E. GROUP *01111

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

  END OF LEVEL   6

THIS IS THE END OF THE DIVISIONS REQUESTED
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**************************************************************************************************************************
     DIVISION    1  (N= 177)    I.E. GROUP *

EIGENVALUE 0.822  AT ITERATION   1

ITEMS IN NEGATIVE GROUP   2  (N=  144)        I.E. GROUP *0
 ascl  inc  astr  bor  astr  pun  betu  pum  bide  con  bide  cor  boeh  cyl  brom  cil  cala  can  calt  pal  caly  sep
 camp  apa  carx  aqu  carx  beb  carx  com  carx  dia  carx  hys  carx  lac  carx  las  carx  lep  carx  pac  carx  sar
 carx  spp  carx  sti  carx  str  carx  vul  carp  car  ceph  occ  cham  cal  chel  gla  cicu  bul  cicu  mac  cirs  arv
 clad  mar  corn  amo  corn  foe  corn  sto  cory  ame  cusc  gro  dryo  cri  elae  umb  eleo  aci  eleo  ell  eleo  ery
 eleo  sma  epil  col  epil  lep  equi  arv  equi  flu  erec  hie  eupa  mac  eupa  per  euth  gra  frag  vir  frax  nig
 frax  pen  gali  asp  gali  tin  gali  trf  geum  can  glyc  bor  hydo  ame  hype  sp.  ilex  ver  impa  cap  iris  vir
 junc  dud  junc  eff  junc  nod  lath  pal  leer  ory  lemn  min  lemn  tri  lycp  ame  lycp  uni  lyth  sal  ment  arv
 meny  tri  mite  nud  nemo  muc  nuph  adv  nymp  odo  onoc  sen  osmu  reg  part  qui  pelt  vir  phal  aru  pile  pum
 pinu  str  poly  amp  poly  hyd  pota  ill  pote  fru  pote  pal  pros  pal  pycn  vir  rham  fra  rhyn  cap  ribe  ame
 ribe  cyn  ribe  hir  rori  pal  rosa  pal  rubu  his  rubu  pub  rubu  str  sagi  lat  salx  can  salx  dis  salx  exi
 salx  pet  salx  ses  samb  can  scir  acu  scir  atr  scir  cyp  scir  val  scut  gal  sium  sua  sola  dul  soli  alc
 soli  gig  soli  pat  soli  rug  spar  eur  sprt  pec  spir  alb  symp  foe  thal  das  thel  pal  toxi  rad  toxi  ver
 tria  fra  trie  bor  typh  ang  typh  lat  ulmu  ame  utri  vul  vacc  ang  vacc  oxy  vibu  len  viol  cuc  viti  rip
 wood  vir

ITEMS IN POSITIVE GROUP   3  (N=   33)        I.E. GROUP *1
 acer  neg  acer  rub  acer  sac  acer  spi  achi  mil  acor  cal  agri  gry  agro  rep  agrs  hye  alga e sp  alis  pla
 alli  can  alnu  rug  alop  aeq  amel  spp  amph  bra  andr  gla  anem  can  apio  ame  apoc  and  apoc  sib  aris  tri
 armo  lac  aron  mel  ascl  syr  astr  cil  astr  dum  astr  jun  astr  lae  astr  lat  astr  lon  astr  mac  astr  nov


  END OF LEVEL   1


**************************************************************************************************************************
     DIVISION    2  (N= 144)    I.E. GROUP *0

EIGENVALUE 0.118  AT ITERATION   2

ITEMS IN NEGATIVE GROUP   4  (N=  142)        I.E. GROUP *00
 astr  pun  betu  pum  bide  con  bide  cor  boeh  cyl  brom  cil  cala  can  calt  pal  caly  sep  camp  apa  carx  aqu
 carx  beb  carx  com  carx  dia  carx  hys  carx  lac  carx  las  carx  lep  carx  pac  carx  sar  carx  spp  carx  sti
 carx  str  carx  vul  carp  car  ceph  occ  cham  cal  chel  gla  cicu  bul  cicu  mac  cirs  arv  clad  mar  corn  amo
 corn  foe  corn  sto  cory  ame  cusc  gro  dryo  cri  elae  umb  eleo  aci  eleo  ell  eleo  ery  eleo  sma  epil  col
 epil  lep  equi  arv  equi  flu  erec  hie  eupa  mac  eupa  per  euth  gra  frag  vir  frax  nig  frax  pen  gali  asp
 gali  tin  gali  trf  geum  can  glyc  bor  hydo  ame  hype  sp.  ilex  ver  impa  cap  iris  vir  junc  dud  junc  eff
 junc  nod  lath  pal  leer  ory  lemn  min  lemn  tri  lycp  ame  lycp  uni  lyth  sal  ment  arv  meny  tri  mite  nud
 nemo  muc  nuph  adv  nymp  odo  onoc  sen  osmu  reg  part  qui  pelt  vir  phal  aru  pile  pum  pinu  str  poly  amp
 poly  hyd  pota  ill  pote  fru  pote  pal  pros  pal  pycn  vir  rham  fra  rhyn  cap  ribe  ame  ribe  cyn  ribe  hir
 rori  pal  rosa  pal  rubu  his  rubu  pub  rubu  str  sagi  lat  salx  can  salx  dis  salx  exi  salx  pet  salx  ses
 samb  can  scir  acu  scir  atr  scir  cyp  scir  val  scut  gal  sium  sua  sola  dul  soli  alc  soli  gig  soli  pat
 soli  rug  spar  eur  sprt  pec  spir  alb  symp  foe  thal  das  thel  pal  toxi  rad  toxi  ver  tria  fra  trie  bor
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 typh  ang  typh  lat  ulmu  ame  utri  vul  vacc  ang  vacc  oxy  vibu  len  viol  cuc  viti  rip  wood  vir

ITEMS IN POSITIVE GROUP   5  (N=    2)         I.E. GROUP *01
 ascl  inc  astr  bor
*****************************************************************************************************************
     DIVISION    3  (N=  33)    I.E. GROUP *1

EIGENVALUE 0.342  AT ITERATION   1

ITEMS IN NEGATIVE GROUP   6  (N=    3)         I.E. GROUP *10
 acor  cal  alnu  rug  apio  ame

ITEMS IN POSITIVE GROUP   7  (N=   30)         I.E. GROUP *11
 acer  neg  acer  rub  acer  sac  acer  spi  achi  mil  agri  gry  agro  rep  agrs  hye  alga e sp  alis  pla  alli  can
 alop  aeq  amel  spp  amph  bra  andr  gla  anem  can  apoc  and  apoc  sib  aris  tri  armo  lac  aron  mel  ascl  syr
 astr  cil  astr  dum  astr  jun  astr  lae  astr  lat  astr  lon  astr  mac  astr  nov


  END OF LEVEL   2


*****************************************************************************************************************
     DIVISION    4  (N= 142)    I.E. GROUP *00

EIGENVALUE 0.105  AT ITERATION   2

ITEMS IN NEGATIVE GROUP   8  (N=   72)         I.E. GROUP *000
 betu  pum  bide  cor  boeh  cyl  cala  can  camp  apa  carx  aqu  carx  com  carx  dia  carx  hys  carx  las  carx  pac
 carx  sar  ceph  occ  cham  cal  cicu  bul  clad  mar  dryo  cri  eleo  aci  eleo  ell  eleo  ery  eleo  sma  epil  lep
 equi  flu  erec  hie  euth  gra  frag  vir  gali  tin  glyc  bor  hype  sp.  iris  vir  junc  dud  junc  eff  junc  nod
 leer  ory  lemn  min  lemn  tri  lycp  ame  lycp  uni  meny  tri  nemo  muc  nuph  adv  nymp  odo  pelt  vir  phal  aru
 pinu  str  poly  amp  poly  hyd  pota  ill  pote  pal  pros  pal  rhyn  cap  rubu  his  sagi  lat  salx  dis  salx  exi
 salx  ses  scir  acu  scir  atr  scir  cyp  scir  val  scut  gal  sola  dul  spar  eur  sprt  pec  spir  alb  tria  fra
 trie  bor  typh  lat  utri  vul  vacc  ang  vacc  oxy  wood  vir

ITEMS IN POSITIVE GROUP   9  (N=   70)         I.E. GROUP *001
 astr  pun  bide  con  brom  cil  calt  pal  caly  sep  carx  beb  carx  lac  carx  lep  carx  spp  carx  sti  carx  str
 carx  vul  carp  car  chel  gla  cicu  mac  cirs  arv  corn  amo  corn  foe  corn  sto  cory  ame  cusc  gro  elae  umb
 epil  col  equi  arv  eupa  mac  eupa  per  frax  nig  frax  pen  gali  asp  gali  trf  geum  can  hydo  ame  ilex  ver
 impa  cap  lath  pal  lyth  sal  ment  arv  mite  nud  onoc  sen  osmu  reg  part  qui  pile  pum  pote  fru  pycn  vir
 rham  fra  ribe  ame  ribe  cyn  ribe  hir  rori  pal  rosa  pal  rubu  pub  rubu  str  salx  can  salx  pet  samb  can
 sium  sua  soli  alc  soli  gig  soli  pat  soli  rug  symp  foe  thal  das  thel  pal  toxi  rad  toxi  ver  typh  ang
 ulmu  ame  vibu  len  viol  cuc  viti  rip
*****************************************************************************************************************
     DIVISION    5  (N=   2)    I.E. GROUP *01

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

*****************************************************************************************************************
```

```
     DIVISION    6  (N=   3)    I.E. GROUP *10

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

************************************************************************************************
     DIVISION    7  (N=  30)    I.E. GROUP *11

EIGENVALUE 0.033  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  14  (N=   29)        I.E. GROUP *110
 acer  neg  acer  rub  acer  sac  acer  spi  achi  mil  agri  gry  agro  rep  agrs  hye  alga e sp  alis  pla  alli  can
 alop  aeq  amel  spp  amph  bra  andr  gla  anem  can  apoc  and  apoc  sib  aris  tri  armo  lac  ascl  syr  astr  cil
 astr  dum  astr  jun  astr  lae  astr  lat  astr  lon  astr  mac  astr  nov

ITEMS IN POSITIVE GROUP  15  (N=    1)        I.E. GROUP *111
 aron  mel


  END OF LEVEL   3

************************************************************************************************
     DIVISION    8  (N=  72)    I.E. GROUP *000

EIGENVALUE 0.086  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  16  (N=   37)        I.E. GROUP *0000
 cala  can  camp  apa  carx  aqu  carx  las  carx  pac  cham  cal  clad  mar  eleo  sma  euth  gra  glyc  bor  hype  sp.
 iris  vir  junc  dud  junc  nod  lemn  min  lycp  uni  meny  tri  nemo  muc  nuph  adv  pelt  vir  phal  aru  pinu  str
 rhyn  cap  rubu  his  scir  acu  scir  cyp  scut  gal  sola  dul  spar  eur  sprt  pec  spir  alb  tria  fra  trie  bor
 typh  lat  utri  vul  vacc  ang  wood  vir

ITEMS IN POSITIVE GROUP  17  (N=   35)        I.E. GROUP *0001
 betu  pum  bide  cor  boeh  cyl  carx  com  carx  dia  carx  hys  carx  sar  ceph  occ  cicu  bul  dryo  cri  eleo  aci
 eleo  ell  eleo  ery  epil  lep  equi  flu  erec  hie  frag  vir  gali  tin  junc  eff  leer  ory  lemn  tri  lycp  ame
 nymp  odo  poly  amp  poly  hyd  pota  ill  pote  pal  pros  pal  sagi  lat  salx  dis  salx  exi  salx  ses  scir  atr
 scir  val  vacc  oxy
************************************************************************************************
     DIVISION    9  (N=  70)    I.E. GROUP *001

EIGENVALUE 0.058  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  18  (N=   69)        I.E. GROUP *0010
 bide  con  brom  cil  calt  pal  caly  sep  carx  beb  carx  lac  carx  lep  carx  spp  carx  sti  carx  str  carx  vul
 carp  car  chel  gla  cicu  mac  cirs  arv  corn  amo  corn  foe  corn  sto  cory  ame  cusc  gro  elae  umb  epil  col
 equi  arv  eupa  mac  eupa  per  frax  nig  frax  pen  gali  asp  gali  trf  geum  can  hydo  ame  ilex  ver  impa  cap
 lath  pal  lyth  sal  ment  arv  mite  nud  onoc  sen  osmu  reg  part  qui  pile  pum  pote  fru  pycn  vir  rham  fra
 ribe  ame  ribe  cyn  ribe  hir  rori  pal  rosa  pal  rubu  pub  rubu  str  salx  can  salx  pet  samb  can  sium  sua
 soli  alc  soli  gig  soli  pat  soli  rug  symp  foe  thal  das  thel  pal  toxi  rad  toxi  ver  typh  ang  ulmu  ame
```

```
 vibu  len  viol  cuc  viti  rip

ITEMS IN POSITIVE GROUP  19  (N=    1)         I.E. GROUP *0011
 astr  pun
*************************************************************************************************
     DIVISION   14  (N=  29)    I.E. GROUP *110
EIGENVALUE 0.011  AT ITERATION   2

ITEMS IN NEGATIVE GROUP  28  (N=    1)         I.E. GROUP *1100
 acer  sac

ITEMS IN POSITIVE GROUP  29  (N=   28)         I.E. GROUP *1101
 acer  neg  acer  rub  acer  spi  achi  mil  agri  gry  agro  rep  agrs  hye  alga e sp  alis  pla  alli  can  alop  aeq
 amel  spp  amph  bra  andr  gla  anem  can  apoc  and  apoc  sib  aris  tri  armo  lac  ascl  syr  astr  cil  astr  dum
 astr  jun  astr  lae  astr  lat  astr  lon  astr  mac  astr  nov
*************************************************************************************************
     DIVISION   15  (N=   1)    I.E. GROUP *111

     DIVISION FAILS - THERE ARE TOO FEW ITEMS


  END OF LEVEL   4


*************************************************************************************************
     DIVISION   16  (N=  37)    I.E. GROUP *0000

EIGENVALUE 0.094  AT ITERATION   2

ITEMS IN NEGATIVE GROUP  32  (N=   32)         I.E. GROUP *00000
 cala  can  carx  aqu  carx  las  carx  pac  cham  cal  clad  mar  eleo  sma  euth  gra  glyc  bor  hype  sp.  iris  vir
 junc  dud  junc  nod  lemn  min  meny  tri  nemo  muc  nuph  adv  pelt  vir  phal  aru  pinu  str  rhyn  cap  rubu  his
 scir  acu  scir  cyp  spar  eur  sprt  pec  tria  fra  trie  bor  typh  lat  utri  vul  vacc  ang  wood  vir

ITEMS IN POSITIVE GROUP  33  (N=    5)         I.E. GROUP *00001
 camp  apa  lycp  uni  scut  gal  sola  dul  spir  alb
*************************************************************************************************
     DIVISION   17  (N=  35)    I.E. GROUP *0001

EIGENVALUE 0.031  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  34  (N=   23)         I.E. GROUP *00010
 betu  pum  boeh  cyl  carx  com  carx  dia  ceph  occ  dryo  cri  eleo  aci  eleo  ell  eleo  ery  erec  hie  frag  vir
 junc  eff  lemn  tri  nymp  odo  pota  ill  pote  pal  pros  pal  sagi  lat  salx  exi  salx  ses  scir  atr  scir  val
 vacc  oxy

ITEMS IN POSITIVE GROUP  35  (N=   12)         I.E. GROUP *00011
 bide  cor  carx  hys  carx  sar  cicu  bul  epil  lep  equi  flu  gali  tin  leer  ory  lycp  ame  poly  amp  poly  hyd
```

```
 salx  dis
****************************************************************************************************
     DIVISION   18  (N=  69)    I.E. GROUP *0010

EIGENVALUE 0.001  AT ITERATION   0

ITEMS IN NEGATIVE GROUP  36  (N=   47)         I.E. GROUP *00100
 calt  pal  caly  sep  carx  beb  carx  lac  carx  lep  carx  str  carx  vul  chel  gla  cicu  mac  cirs  arv  corn  amo
 corn  foe  corn  sto  equi  arv  eupa  mac  gali  asp  gali  trf  geum  can  hydo  ame  lath  pal  lyth  sal  ment  arv
 mite  nud  osmu  reg  pote  fru  pycn  vir  ribe  ame  ribe  cyn  ribe  hir  rosa  pal  rubu  pub  salx  can  salx  pet
 samb  can  sium  sua  soli  alc  soli  pat  soli  rug  symp  foe  thal  das  thel  pal  toxi  ver  typh  ang  ulmu  ame
 vibu  len  viol  cuc  viti  rip

ITEMS IN POSITIVE GROUP  37  (N=   22)         I.E. GROUP *00101
 bide  con  brom  cil  carx  spp  carx  sti  carp  car  cory  ame  cusc  gro  elae  umb  epil  col  eupa  per  frax  nig
 frax  pen  ilex  ver  impa  cap  onoc  sen  part  qui  pile  pum  rham  fra  rori  pal  rubu  str  soli  gig  toxi  rad
****************************************************************************************************
     DIVISION   19  (N=   1)    I.E. GROUP *0011

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

****************************************************************************************************
     DIVISION   28  (N=   1)    I.E. GROUP *1100

     DIVISION FAILS - THERE ARE TOO FEW ITEMS

****************************************************************************************************
     DIVISION   29  (N=  28)    I.E. GROUP *1101


  END OF LEVEL   5


****************************************************************************************************
     DIVISION   32  (N=  32)    I.E. GROUP *00000

EIGENVALUE 0.098  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  64  (N=    2)         I.E. GROUP *000000
 carx  las  meny  tri

ITEMS IN POSITIVE GROUP  65  (N=   30)         I.E. GROUP *000001
 cala  can  carx  aqu  carx  pac  cham  cal  clad  mar  eleo  sma  euth  gra  glyc  bor  hype  sp.  iris  vir  junc  dud
 junc  nod  lemn  min  nemo  muc  nuph  adv  pelt  vir  phal  aru  pinu  str  rhyn  cap  rubu  his  scir  acu  scir  cyp
 spar  eur  sprt  pec  tria  fra  trie  bor  typh  lat  utri  vul  vacc  ang  wood  vir
****************************************************************************************************
     DIVISION   33  (N=   5)    I.E. GROUP *00001
```

```
EIGENVALUE 0.045  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  66  (N=    2)          I.E. GROUP *000010
 lycp  uni  sola  dul

ITEMS IN POSITIVE GROUP  67  (N=    3)          I.E. GROUP *000011
 camp  apa  scut  gal  spir  alb
*********************************************************************************************************************
     DIVISION   34  (N=  23)    I.E. GROUP *00010

EIGENVALUE 0.017  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  68  (N=    1)          I.E. GROUP *000100
 eleo  ery

ITEMS IN POSITIVE GROUP  69  (N=   22)          I.E. GROUP *000101
 betu  pum  boeh  cyl  carx  com  carx  dia  ceph  occ  dryo  cri  eleo  aci  eleo  ell  erec  hie  frag  vir  junc  eff
 lemn  tri  nymp  odo  pota  ill  pote  pal  pros  pal  sagi  lat  salx  exi  salx  ses  scir  atr  scir  val  vacc  oxy
*********************************************************************************************************************
     DIVISION   35  (N=  12)    I.E. GROUP *00011

EIGENVALUE 0.018  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  70  (N=    1)          I.E. GROUP *000110
 poly  amp

ITEMS IN POSITIVE GROUP  71  (N=   11)          I.E. GROUP *000111
 bide  cor  carx  hys  carx  sar  cicu  bul  epil  lep  equi  flu  gali  tin  leer  ory  lycp  ame  poly  hyd  salx  dis
*********************************************************************************************************************
     DIVISION   36  (N=  47)    I.E. GROUP *00100

EIGENVALUE 0.001  AT ITERATION   0

ITEMS IN NEGATIVE GROUP  72  (N=   13)          I.E. GROUP *001000
 carx  beb  carx  lac  carx  str  carx  vul  cirs  arv  lyth  sal  ment  arv  osmu  reg  rosa  pal  salx  pet  sium  sua
 thel  pal  typh  ang

ITEMS IN POSITIVE GROUP  73  (N=   34)          I.E. GROUP *001001
 calt  pal  caly  sep  carx  lep  chel  gla  cicu  mac  corn  amo  corn  foe  corn  sto  equi  arv  eupa  mac  gali  asp
 gali  trf  geum  can  hydo  ame  lath  pal  mite  nud  pote  fru  pycn  vir  ribe  ame  ribe  cyn  ribe  hir  rubu  pub
 salx  can  samb  can  soli  alc  soli  pat  soli  rug  symp  foe  thal  das  toxi  ver  ulmu  ame  vibu  len  viol  cuc
 viti  rip
*********************************************************************************************************************
     DIVISION   37  (N=  22)    I.E. GROUP *00101

EIGENVALUE 0.028  AT ITERATION   1

ITEMS IN NEGATIVE GROUP  74  (N=   20)          I.E. GROUP *001010
 bide  con  brom  cil  carx  spp  carx  sti  carp  car  cory  ame  cusc  gro  elae  umb  epil  col  eupa  per  frax  nig
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```
 frax  pen  onoc  sen  part  qui  pile  pum  rham  fra  rori  pal  rubu  str  soli  gig  toxi  rad

ITEMS IN POSITIVE GROUP  75  (N=    2)         I.E. GROUP *001011
 ilex  ver  impa  cap


  END OF LEVEL   6


THIS IS THE END OF THE DIVISIONS REQUESTED
***************************************************************************************************************************
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ORDER OF SPECIES INCLUDING RARER ONES
  56 carx  las! 118 meny  tri!  45 cala  can!  50 carx  aqu!  58 carx  pac!  66 cham  cal!  71 clad  mar!  82 eleo  sma
  90 euth  gra!  98 glyc  bor! 100 hype  sp.! 103 iris  vir! 104 junc  dud! 106 junc  nod! 110 lemn  min! 121 nemo  muc
 122 nuph  adv! 127 pelt  vir! 128 phal  aru! 130 pinu  str! 140 rhyn  cap! 146 rubu  his! 156 scir  acu! 158 scir  cyp
 169 spar  eur! 170 sprt  pec! 177 tria  fra! 178 trie  bor! 180 typh  lat! 183 utri  vul! 184 vacc  ang! 189 wood  vir
 114 lycp  uni! 164 sola  dul!  49 camp  apa! 160 scut  gal! 171 spir  alb!  81 eleo  ery!  40 betu  pum!  43 boeh  cyl
  52 carx  com!  53 carx  dia!  65 ceph  occ!  77 dryo  cri!  79 eleo  aci!  80 eleo  ell!  87 erec  hie!  91 frag  vir
 105 junc  eff! 111 lemn  tri! 123 nymp  odo! 133 pota  ill! 135 pote  pal! 136 pros  pal! 149 sagi  lat! 152 salx  exi
 154 salx  ses! 157 scir  atr! 159 scir  val! 185 vacc  oxy! 131 poly  amp!  42 bide  cor!  54 carx  hys!  59 carx  sar
  68 cicu  bul!  84 epil  lep!  86 equi  flu!  95 gali  tin! 109 leer  ory! 113 lycp  ame! 132 poly  hyd! 151 salx  dis
  51 carx  beb!  55 carx  lac!  62 carx  str!  63 carx  vul!  70 cirs  arv! 116 lyth  sal! 117 ment  arv! 125 osmu  reg
 145 rosa  pal! 153 salx  pet! 163 sium  sua! 174 thel  pal! 179 typh  ang!  47 calt  pal!  48 caly  sep!  57 carx  lep
  67 chel  gla!  69 cicu  mac!  72 corn  amo!  73 corn  foe!  74 corn  sto!  85 equi  arv!  88 eupa  mac!  94 gali  asp
  96 gali  trf!  97 geum  can!  99 hydo  ame! 108 lath  pal! 119 mite  nud! 134 pote  fru! 137 pycn  vir! 141 ribe  ame
 142 ribe  cyn! 143 ribe  hir! 147 rubu  pub! 150 salx  can! 155 samb  can! 165 soli  alc! 167 soli  pat! 168 soli  rug
 172 symp  foe! 173 thal  das! 176 toxi  ver! 181 ulmu  ame! 186 vibu  len! 187 viol  cuc! 188 viti  rip!  41 bide  con
  44 brom  cil!  60 carx  spp!  61 carx  sti!  64 carp  car!  75 cory  ame!  76 cusc  gro!  78 elae  umb!  83 epil  col
  89 eupa  per!  92 frax  nig!  93 frax  pen! 124 onoc  sen! 126 part  qui! 129 pile  pum! 139 rham  fra! 144 rori  pal
 148 rubu  str! 166 soli  gig! 175 toxi  rad! 101 ilex  ver! 102 impa  cap!  39 astr  pun!  27 ascl  inc!  29 astr  bor
   6 acor  cal!  14 alnu  rug!  20 apio  ame!   3 acer  sac!   1 acer  neg!   2 acer  rub!   4 acer  spi!   5 achi  mil
   7 agri  gry!   8 agro  rep!   9 agrs  hye!  11 alga e sp!  12 alis  pla!  13 alli  can!  15 alop  aeq!  16 amel  spp
  17 amph  bra!  18 andr  gla!  19 anem  can!  21 apoc  and!  22 apoc  sib!  24 aris  tri!  25 armo  lac!  28 ascl  syr
  30 astr  cil!  31 astr  dum!  32 astr  jun!  33 astr  lae!  35 astr  lat!  36 astr  lon!  37 astr  mac!  38 astr  nov
  26 aron  mel!


ORDER OF SAMPLE UNITS
  43 NB        !  32 ORR       !  40 SR        !  41 FHR       !  23 WAM1      !  42 NR        !  34 RAN1      !  35 RAN2
   7 BEA1      !   8 BEA2      !  11 CAS1      !  13 CAS3      !  18 EMW       !  19 EME1      !  20 EME2      !  21 HAR1
  30 M591      !  31 M592      !  36 WIL1      !   4 LEE1      !   5 LEE2      !   6 LEE3      !  12 CAS2      !  17 LIV2
  24 WAM2      !  25 WFK       !   9 WAT1      !  10 WAT2      !  14 TEE1      !  15 TEE2      !  16 LIV1      !  22 HAR2
  26 HM1       !  27 HM2       !  28 HM3       !  29 HM4       !  33 IRW       !  37 WIL2      !  38 THR1      !  39 THR2
   1 MAU1      !   2 MAU2      !   3 MAU3      !
```

```
                    NOSFWNRRBBCCEEEHMMWLLLCLWWWWTTLHHHHHIWTTMMM
                    BRRHARAAEEAAMMMA55IEEEAIAFAAEEIAMMMMRIHHAAA
                     R RM NNAASSWEER99LEEESVMKTTEEVR1234WLRRUUU
                        1 121213 121121123222 121212      212123



 56 carx  las  1511--2-15533414444121111------------------  000000
 45 cala  can  -2325-511231121-453313211--111--1-11111----  000001
 66 cham  cal  512--1-------------------------------------  000001
 98 glyc  bor  ---1-1---1---------------------------------  000001
100 hype  sp.  -1--------------1----------1---------------  000001
103 iris  vir  ---1--------1--1-111----1---1--------------  000001
110 lemn  min  -----1------1----------------1-------------  000001
122 nuph  adv  ----1------------11------------------------  000001
128 phal  aru  ---145-1--1--155------2--------11---1-1----  000001
169 spar  eur  ----1----1------------1-2--------1--1------  000001
170 sprt  pec  --53---------------------------------------  000001
177 tria  fra  -1------11------1--------1-----------------  000001
180 typh  lat  ----23-1212221111--322311221-115-1-1--3----  000001
184 vacc  ang  4------------------------------------------  000001
114 lycp  uni  -2---11-1112111-121---1111111111--111111---  000010
164 sola  dul  ----1---------1-1--11---1---1--1-----1-1---  000010
 49 camp  apa  ----1---111-1--1111111111--111111---11-----  000011
160 scut  gal  ----1---111111--111111--11-1-111----1111---  000011
171 spir  alb  ---1----1---1-----121----311-11---1--2-----  000011
 81 eleo  ery  -1----113334------11--1-------1--------1---  000100
 52 carx  com  ------1111-2-11-------11-------1-----------  000101
 65 ceph  occ  ----------------21-------1-----------------  000101
 80 eleo  ell  ------11--------1------3-------------------  000101
105 junc  eff  ------15-----------------------------------  000101
123 nymp  odo  ------32-----------------------------------  000101
135 pote  pal  --------1111-1--11----1------1-------------  000101
149 sagi  lat  ------1-1232-221-1-323211------------------  000101
152 salx  exi  ------------233-11-----------1-------------  000101
154 salx  ses  ------------1-1-11-------------------------  000101
159 scir  val  ------1--1---------1---1-------------------  000101
131 poly  amp  ----1-311-1111111111111-11--11-11----1-----  000110
 42 bide  cor  ---------1111----111--1-1-1-11-------------  000111
 54 carx  hys  ---------1-1--1-------1--1----------1-1----  000111
 59 carx  sar  ----------1---1-----1------1---------------  000111
 68 cicu  bul  ------1-1111111-1111-11111--11-1-----1-1---  000111
 84 epil  lep  ----------111--1---------------1-----------  000111
 86 equi  flu  -----------1---1-------------1-------------  000111



 95 gali  tin  ------11111111111111-11111111111-1--11-----  000111
109 leer  ory  -------211-11----------1-------1------12---  000111
113 lycp  ame  ------1----1-11--1----1----1--------1------  000111
132 poly  hyd  ------12-----------1-----------1-------1---  000111
151 salx  dis  ------------2-2--------1-1--------2---2----  000111
 55 carx  lac  ----1-1-2----41----423115-342-3--515113----  001000
 62 carx  str  1-----1-42-15-13214-12-11-31553-5-5545-----  001000
116 lyth  sal  ------------3-------4145-324-531-----------  001000
117 ment  arv  -------1-----11--1-1-1-11---111-1----11----  001000
153 salx  pet  --------1----------------1---1----1--------  001000
174 thel  pal  --------21-12111312211111322322412112111---  001000
179 typh  ang  --------------------11---3------------15---  001000
 47 calt  pal  -----------------------1--12---1------1----  001001
 69 cicu  mac  ---------------------------1----1-----1----  001001
 72 corn  amo  ----------------------------31----221-31---  001001
 73 corn  foe  --------------------------1-----1-4---2----  001001
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 74 corn  sto  --------1---1-------------32111121311-21---  001001
 85 equi  arv  ---------------------------1----1-1--------  001001
 88 eupa  mac  ------------1---111-----1-1222122123131----  001001
 94 gali  asp  --------------------------------1--11-1----  001001
134 pote  fru  --------------------------11--------1------  001001
137 pycn  vir  --------------------------------1---21-----  001001
141 ribe  ame  ----------------------------1-1-------1----  001001
143 ribe  hir  ---------------------------11-1--1-----1---  001001
147 rubu  pub  ---------------------------1----1--11-1----  001001
155 samb  can  ---------------------------1--------1-1----  001001
165 soli  alc  ----------------111--------1111-2-212------  001001
167 soli  pat  ---------------------------1--1-------2----  001001
172 symp  foe  ---------------------------------1-21-31---  001001
176 toxi  ver  ---------------------------1-1-----1--2----  001001
 44 brom  cil  ----------1---------------------1--1-------  001010
 89 eupa  per  --------1--------11----1--1--111--1-1-11---  001010
 93 frax  pen  ------------------1-------------1----1-----  001010
124 onoc  sen  ---------1----1----111-11154213-21121311---  001010
126 part  qui  --------------------------------1--1--11---  001010
129 pile  pum  --------1---1----------1------12------13---  001010
139 rham  fra  -----------------------------1--------11---  001010
148 rubu  str  -----------------------------------1---2---  001010
166 soli  gig  -----------------------1--------1---1------  001010
101 ilex  ver  1-----------------1----------1-------------  001011
102 impa  cap  ----1-------1------111-11--122121----334---  001011
 39 astr  pun  ------------------1----11-11213121111211-1-  0011
 27 ascl  inc  ---------1-------1--------1----11-11----1--  01
 29 astr  bor  -----------------------1------1-1----1--1--  01
  6 acor  cal  --------------------------------------2---1  10
 14 alnu  rug  --------------------------------------1-1--  10
 20 apio  ame  -----------------------------1--1-----1-111  10
  3 acer  sac  -------------------------1------------1-554  1100
  1 acer  neg  ------------------------------------------4  1101
  4 acer  spi  ----------------------------------------351  1101
  5 achi  mil  ----------------------------------------23-  1101
  9 agrs  hye  ----------------------------------------1-1  1101
 11 alga e sp  ----------------------------------------21-  1101
 15 alop  aeq  ----------------------------------------11-  1101
 16 amel  spp  ------------------------------------------4  1101
 17 amph  bra  ----------------------------------------111  1101
 18 andr  gla  ----------------------------------------111  1101
 21 apoc  and  ------------------------------------------3  1101
 22 apoc  sib  ----------------------------------------11-  1101
 25 armo  lac  ----------------------------------------11-  1101
 37 astr  mac  ----------------------------------------13-  1101
 38 astr  nov  ----------------------------------------321  1101
 26 aron  mel  1---------------------------------------1--  111

               0000000000000000000000000000000000000000111

          0111111111111111111111111111111111111111
           000001111111111111111111111111111111111
           000110000000000000000000011111111111111
                00111111111111111111000000000000001
                  0000000000011111110000000000001
```